1 FEBRUARY 2012

O.I.T.A.F. Partner

ISR

www.isr.at

English Special

INTERNATIONAL ROPEWAY REVUE

Oscillations in ropeways, part 2

Structural oscillations deriving from the rope/sheave moving system: "potential exciter"

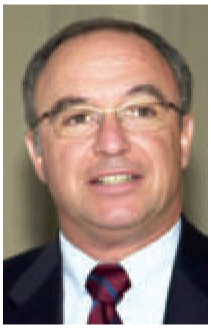


Photo: Archives

Dipl.-Ing. (ETH)
Georg A. Kopanakis

The first part of this series of articles was devoted to the basics of oscillations and waves. In this part we consider oscillations that arise during ropeway operation as a result of movement in the rope and rotation of the sheaves.

In this context, all structural components of the ropeway can be seen as "oscillatable bodies." The rope/sheave subsystems act as "exciters", and grips attached to the rope can also be involved. The rope/sheave subsystems are "harmonic" exciters, and as the frequency of the exciter is the decisive factor for the generation and intensity of an oscillation resulting from harmonic excitation, the first step must be to calculate that frequency.

Calculating the frequency of a periodic disturbance: If a sheave is caused to run over a washboard at constant speed "*v*" (Figure 1), the sheave starts to oscillate.

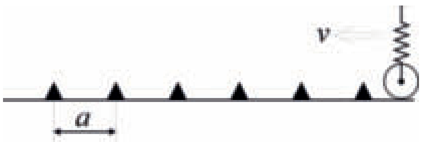


Figure 1: Sheave running over a washboard

At constant rib distance "a", oscillation period "T" is calculated as follows:

$$T = \frac{a}{v} \qquad \text{... (1a)}$$

and the corresponding frequency "*f*" is

$$f = \frac{1}{T} \qquad \text{... (1b)}$$

(1a) in (1b) -> $f = \frac{v}{a}$ ... (2)

That is to say, frequency is equal to speed divided by the interval of the periodic disturbances.

Oscillations caused by the rope/sheave subsystem

Because of its helical surface, a rope running over a sheave constitutes a mechanism generating a forced oscillation, whose frequency is defined by rope speed and strand distance (Figure 2).

Figure 2: Effect of the helical surface of the rope

In the case of a rope with a lay length of λrope passing over a sheave at a speed of "v_{rope}" exciter frequency "$f_{\text{strand-induced}}$" is calculated from equation (2):

$$f_{strand\text{-}induced} = \frac{v_{rope}}{a_{rope}} \qquad \text{...(2a)}$$

In the case of a six-strand rope, exciter frequency is

$$a_{strand} = \frac{\lambda_{rope}}{6} \qquad \text{... (2b)}$$

(2b) in (2a) -> $\boxed{f_{strand\text{-}induced} = \frac{v_{rope}}{\frac{\lambda_{rope}}{6}}}$ ...(3)

and exciter frequency in an n-strand rope is

$$f_{strand\text{-}induced} = \frac{v_{rope}}{\frac{\lambda_{rope}}{n}} \qquad \text{...(3a)}$$

For a 6-strand rope with a diameter of 40 mm moving at a speed of 4 to 6 m/s, therefore, the frequency of strand-induced oscillation is approx. 80 to 130 Hz.

In the case of a wavy rope passing over a sheave, the interval of periodic disturbance "*a*" corresponds to lay length "λ". Exciter frequency is therefore

$$\boxed{f_{lay\text{-}length\text{-}induced} = \frac{v_{rope}}{\lambda}} \qquad \text{...(4)}$$

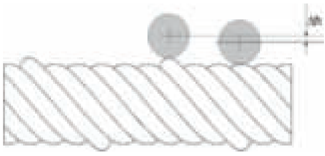


Figure 3: Effect of waviness in the rope

For the same example as above, the frequency of the lay-length-induced oscillation is approx. 14 to 22 Hz.

Oscillations caused by eccentricity or polygonality in sheaves

Eccentric running in a sheave with radius "*R*" (Figure 4) also causes oscillations.

In this case the interval of periodic disturbance "*a*" corresponds to sheave circumference "U_{shave}", and frequency is calculated as

$$\boxed{f_{eccentricity} = \frac{v_{rope}}{U_{sheave}} = \frac{v_{rope}}{2 \cdot \pi \cdot R}} \qquad \text{... (5)}$$

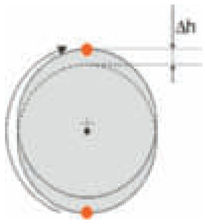


Figure 4: Effect of eccentric running in a sheave

For a sheave with a diameter of 450 mm and a rope speed of 4 to 6 m/s, therefore, the frequency of the oscillation caused by an eccentric sheave is approx. 2.8 to 4.2 Hz.

In the case of polygonality in a sheave (Figures 5 and 6), e.g. caused by lack of stiffness in the rim, the interval of the periodic disturbance is expressed as

$$a_{polygonality} = \frac{U_{sheave}}{n_{polygon\ vertices}}$$

In this case exciter frequency is

$$\boxed{f_{polygonality} = \frac{v_{rope}}{a_{polygonality}} = \frac{v_{rope}}{\dfrac{2 \cdot \pi \cdot R}{n_{polygon\ vertices}}}} \quad ...(6)$$

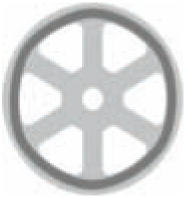


Figure 5: Polygonality in a sheave, e.g. caused by lack of stiffness in the rim

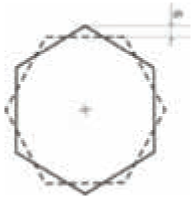


Figure 6: Effect of polygonality in a sheave

For a sheave with a diameter of 3200 mm and five spokes and a rope speed of 4 to 6 m/s, therefore, the frequency of the oscillation caused by polygonality is approx. 2 to 3 Hz.

Structural oscillations deriving from other causes

The following excitation mechanisms also lead to oscillations:

Grip passage over a compression tower (Figure 7): In the case of a continuously circulating ropeway with fixed or detachable grips, the grip jaws make contact with the sheaves. The resulting jolt is a one-off source of excitation that can trigger short-term structural oscillations.

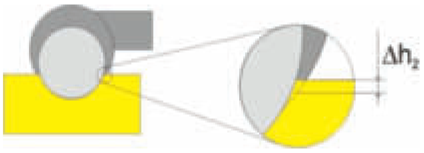


Figure 7: Effect of grip passage over a compression tower

Grip passage under a depression tower (Figure 8): In the case of a depression tower, the grip top passes between the rope and the sheave during travel under a depression sheave. The resulting jolt is again a one-off source of excitation that can trigger short-term structural oscillations.

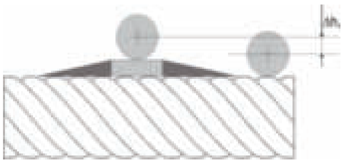


Figure 8: Effect of grip passage under a depression tower

Simultaneous passage of two grips on a tower (Figure 9): During ropeway operation it is possible for two grips to pass over or under the sheave batteries on either side of a tower at the same time, thus creating a force couple. In the case of depression or combination sheave assemblies, this one-off source of excitation can lead to rotational oscillation in the tower, depending on the shape of the grips and the torsional stiffness of the tower. Given an "unfortunate" choice of carrier spacing, the excitation can become periodic, with a corresponding risk of deropement.

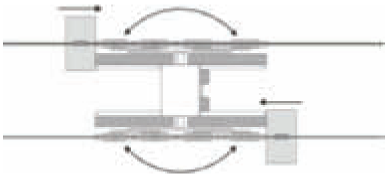


Figure 9: Effect of simultaneous passage of two grips on a tower

Start-up resistance: As in the case of simultaneous passage of two grips on either side of the tower, a force couple can also be generated on system start-up (because of the opposed directions of travel and rolling resistance on either side of the tower), especially where the rolling resistance of the sheaves is high. That can also lead to rotational oscillation.

In the next chapter of this series on "Oscillations in ropeways" we will be looking at ways of eliminating or reducing the oscillations discussed above.

Georg A. Kopanakis

Oscillations in ropeways, part 3

Structural oscillations deriving from the moving rope/sheave system: locating the exciter

In order to tackle oscillations with the help of the methods discussed in Part 1 ("Cable oscillation problems", ISR 6/2011, p. 47), it is first of all necessary to identify the exciter. That is the subject of the third part of this series of articles.

Locating the exciter

The exciter can be identified from the frequency of the resulting oscillation. The first step in locating the exciter is therefore to determine the oscillation's predominant frequencies. In order to find the exciter, the main frequencies measured in the oscillation are then compared with the calculated frequencies of potential exciters on ropeway installations (see Part 2).

Determination of the predominant frequencies: In Part 1, an oscillation or vibration was defined as a back and forward motion relative to a fixed location. In the course of this back and forward motion, changes occur to various parameters of the component involved (stress at a point on a structural component, amplitude and velocity at a certain point, intensity of the emitted sound, acceleration at a certain point). The pattern of one of these parameters, which can be determined with the appropriate measuring equipment, will correspond to that of the oscillation.

Selection of the parameter to be measured: Although it is basically possible to measure any of the above time-variable parameters, there are pronounced differences in terms of both the effort required and the accuracy of the results.

In the case of oscillations in structural ropeway components, selection of the parameter to be measured will normally be based on the following considerations:

Stress at a point on a structural component: It is possible to measure the stresses created in the component with a high degree of accuracy. However, the sensor setup, (glueing the strain gages in place and making the electrical connections) is time-consuming, and there is considerable potential for error. For that reason this can be considered a very good solution for permanent monitoring (especially where the structural components can be delivered with the strain gages ready mounted ex works), but the method cannot be recommended for temporary or one-off monitoring.

Amplitude at a certain point (displacement sensor): It is basically possible to monitor and measure the changing position of a given point during an oscillation cycle. In our case, however, the amplitude (the amount of displacement to be measured) is very small, and that has a negative effect on the accuracy of the measurements. Above all, there is no reference point at rest that can be used as the basis for measurement. For these reasons, the amplitude of the oscillation will only very rarely be a suitable parameter for determining the structure of oscillations in ropeway installations.

Velocity at a certain point: As velocity is the expression of displacement over time, measuring velocity involves the same difficulties as measuring the amplitude of the oscillation and is equally rarely used.

Intensity of emitted sound: A structural component that is made to oscillate emits a sound at a frequency corresponding to the oscillation. It is theoretically possible to measure and analyze the sound of the oscillation to determine the predominant frequencies involved, but in practice it is impossible to insulate the measuring equipment from the various ambient sounds so that results are falsified by measured sounds that have nothing to do with the oscillation to be studied. Sound measurement as a way of determining the predominant frequencies in the oscillation is accordingly a theoretical possibility, but reservations apply to practical application.

Acceleration at a certain point: The market today offers a wide choice of accelerometers for the direct measurement of acceleration, and this parameter is easily measured. The method also produces accurate results as long as due consideration is paid to the following two points:

- The highest frequency to be measured must lie within the range of the equipment used.
- The sensor must be connected rigidly to the structural component to be monitored, and the natural frequency of the connector must be much higher than the expected range of frequencies to be measured.

Procedure: It is important to ensure that monitoring is performed without causing any significant changes to either the mass or the stiffness of the component involved as that would also change its natural frequency (see Part 1, "Free and forced oscillations and natural frequency"). Above all, this means that no-one should be standing on a tower while measurements are taken. Nor should any equipment be placed on the component involved (e.g. maintenance platform). If it is not possible to leave the equipment on the ground, it should be located as far away as possible from the structural component to be measured.

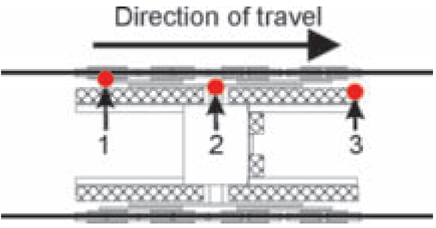
The measurements required to determine the structure of the oscillation should be taken with the ropeway installation operating at various speeds. That makes it possible to relate the frequency detected and the operating speed of the installation, which facilitates identification of the exciter. It also reveals any cases where the exciter has a natural frequency that is close to the frequencies the occur during operation of the ropeway.

To guarantee comparability of the results of the measurements taken at different operating speeds, it is important to ensure that all testing is performed in the presence of the same section of the rope and that the section used is representative of the rope as a whole (which clearly eliminates the area of the splice). In the case of a largely uniform rope, the middle section is the most suitable choice.

If the measurements cannot all be taken at the same time, note should be taken of any differences in climatic conditions. Differences in temperature, for example, lead to changes in the stiffness of the sheave linings and hence to changes in the oscillation behavior of the system as a whole. Similarly, ice buildup on the structural component to be tested has effects on both mass and internal damping and thus on oscillation behavior.

Example: Measuring oscillation on a ropeway tower

A typical test setup for a tower is shown in diagrammatic form in Figure 1.



Graphics: G. Kopanakis

Figure 1: Plan view of a tower head with the positions of the sensors

Sensor no.1 records acceleration at one of the rope sheaves, sensor no. 2 at the tower head (main axle of the sheave battery) and sensor no. 3 at another point on the tower. Normally sensor no. 3 is attached to the structural component that is at risk of damage as a result of the oscillation. In the figure, sensor no. 3 is located on the maintenance platform. With this setup it is possible to compare the intensity of the oscillation deriving from the rope/sheave system with the intensity of the oscillation transmitted to the tower via the sheave battery and also with the intensity of the secondary oscillation created in the part of the tower that is at risk.

The acceleration is usually measured in its main direction (vertical), although it can be measured in all three directions if required. In Figure 2, acceleration is plotted as measured vertically.

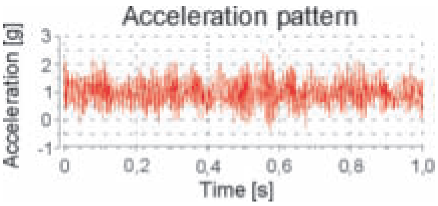


Figure 2: Example of an acceleration plot

Analysis of the data: The resulting oscillation pattern (selected parameter as a function of time, e.g. acceleration / Figure 2) is subjected to a Fourier transformation (breakdown of the time function into its harmonic components / Figure 3).

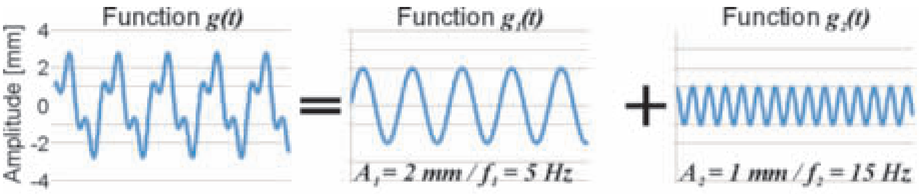


Figure 3: Breakdown of function g(t) into its harmonic components g1(t) and g2(t)

This produces what is known as the frequency spectrum of the measured parameter, with the amplitude of each harmonic component plotted over frequency (Figure 4).

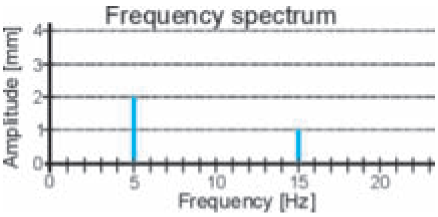


Figure 4: Frequency spectrum of the function g(t)

The height of the amplitude indicates whether the harmonic component concerned makes a significant contribution to the development of the oscillation (Figure 5).

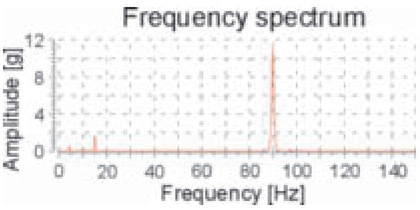


Figure 5: Frequency spectrum of the acceleration pattern in Figure 2

Comparison between calculated and measured frequencies: The frequencies thus obtained of the harmonic oscillation components making a significant contribution to the oscillation are then compared in graphic (Figure 6) or tabular form with the possible frequencies for the case involved.

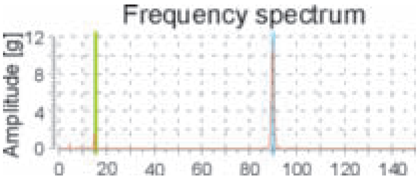


Figure 6: Graphic comparison of calculated and measured frequencies

The potential exciter with a frequency that matches a frequency obtained as described above makes a major contribution to the oscillation and is the cause of the problem.

The green bar corresponds to the frequency of lay-length-induced oscillation (e.g. caused by waviness in the rope). The blue bar corresponds to that of strand-induced oscillation. As can be seen, the frequency of the harmonic component with the biggest amplitude matches that of strand-induced oscillation, but there is a second oscillation component in the form of waviness in the rope. It can be concluded that in this case both the rope/sheave system and (at a lower intensity) the waviness of the rope function as exciters. However, it may be that the frequency deriving from waviness in the rope is identical with the natural frequency of a structural component and will ultimately be the cause of any resulting damage.

Now that the exciter or exciters have been identified, the next step – where possible – will be to eliminate them or at least reduce their effects. The methods available for this purpose form the subject of the next part of this series of articles on oscillations in ropeways.

Georg A. Kopanakis

First solar ski lift built in Tenna, Switzerland

Photos: Bartholet

Tenna's Solar Ski Lift – from the drawing board to the mountain

Bartholet Maschinenbau AG (BMF), with its headquarters in Flums, Switzerland, at the heart of the beautiful Heidiland region, is a leading Swiss company worldwide in the fields of ropeway systems, amusement park facilities, mechanical engineering and metal processing. Thanks to its comprehensive and future-oriented range of products and services in terms of development, production and distribution, BMF has enjoyed a high level of acceptance amongst its international clientele for nearly fifty years now.

A motivated and highly qualified team of more than 200 employees plus modern facilities guarantee fast and efficient customer-oriented working in planning and engineering for complex and innovative projects. One such pioneering project is the new solar-powered ski lift which opened in the Swiss village of Tenna in the Safien Valley on 17 December 2011. The development, design engineering and production of this prototype system is also an important step forward for the BMF company.

The Solar Ski Lift – development and opening

On 17 December the world's first solar-powered ski lift, which has a rated transport capacity of 800 persons per hour, was officially opened in a little mountain village in Canton Grisons by the name of Tenna, which has 112 inhabitants. Development work on the innovative project began much earlier. In 2008 Bartholet Maschinenbau AG as the lift manufacturer, Solar Wings AG as the solar engineering company, and Professor Franz Baumgartner as a well known solar expert from the Zurich University of Applied Sciences (ZHAW) came together for the first time to collaborate on a photovoltaic project in Waldshut, Germany. The project generated synergies, which led to the next successful step in 2008 in the form of a photovoltaic system for the Flumroc company in Flums in Canton Sargans. That in turn formed the basis for an innovative rope suspension solution for a multi-axis photovoltaic system.

The solar-powered ski lift is 460 meters long and generates about 90,000 kilowatt hours of electricity a year. That is enough to run the ski lift and also to meet the energy requirements of twelve homes. 82 solar wings are swivel-mounted between two ropes suspended along the line of the lift above the haul rope and automatically controlled to follow

TECHNICAL DATA

SOLAR LIFT – TENNA, SWITZERLAND

Manufacturer	BMF - Bartholet Maschinenbau AG
System	Solar-powered ski lift / T-bar surface lift
Line length	450 m
Vertical height	135 m
Drive	Lower station
Tensioning	Upper station
Rope speed	0.5–3 m/s
Transit time	approx. 3 min.
Transport capacity	800 pph
Drive output	35 kW
Annual power consumption	approx. 29,000 kW
Number of towers	5
Highest tower	11 m
Commissioning	17 December 2011

Tenna's Solar Ski Lift: an Ideal solution for a green tourism philosophy

the path of the sun through the sky for maximum efficiency. When it snows, the wings move to the vertical position to avoid snow deposition, and beyond a certain wind speed they swivel into the horizontal position so as to minimize the wind load.

Ideal solution for a green tourism philosophy

The solar-powered ski lift now forms part of Tenna's eco-friendly infrastructure and is an ideal solution for the green tourism philosophy of the Safien Valley. This is one of Switzerland's structurally disadvantaged regions, with just under a thousand inhabitants, which makes it all the more dependent on tourism for its future prosperity.

TECHNICAL DATA

SOLAR SYSTEM – TENNA, SWITZERLAND

Length	330 m
Mounting	Between two ropes located above the haul rope
Energy supply	82 solar wings with 3 panels each, angled at 30°
Panels	246 polycrystalline panels 245 W, total 60 kWp
Wind	Anemometer, horizontal wing position to minimize wind load
Snow	Snow sensor, almost vertical wing position to minimize load
Adjustment	Cable, every 10 minutes
Annual generation	90,000 kW

OITAF Seminar 2012

"Safety of transportation by rope: legal issues and practical experience"

This year the OITAF seminar will be held in the framework of SAM in Grenoble/France on 25 April. It is being organized by Work Committee no. 4 (Legal, Administrative, Economic and Statistical Matters). At the seminar, ropeway safety – a central concern of OITAF – will be discussed at more than the purely technical level. The presentations will relate to two main topics:

- The morning session will be devoted to experience to date with the implementation of measures taken in the last few years to prevent passengers from falling off chairlifts, with a strong focus on technical and operational solutions for making lifts safer for children.
- The afternoon program will cover the legal aspects of product and environmental liability and will include a paper on the Austrian regulations for avalanche protection for ropeways.

Jörg Schröttner, head of the supreme ropeway authority at the Austrian Ministry of Transport and Chairman of OITAF Work Committee no. 4, will chair the proceedings. The speakers are all recognized experts in their fields. For the full program details and registration procedures, go to the OITAF website at www.oitaf.org.

From Val Thorens to Stanserhorn

Gangloff Cabins specialize in customized solutions for funicular and APM cars and aerial tramway cabins and gondolas.

Whenever something special is called for, including the refurbishment of historical funicular cars, Marc Pfister can rely on the know-how and long years of experience of his engineers and skilled labour force. With the support of Michael Stähli as Senior Engineer, Marc Pfister is able to satisfy a wide range of individual customer requirements – like the two funicular cars designed and built for the Ocean Express in a Hong Kong leisure park or cars for power station operations as in the case of the Hinterrhein and Heiligenkreuz power plants.

One big event in 2012 will be the opening of the Stanserhorn Cabrio, where the Gangloff cars had to be specially engineered for the unconventional location of the rope and other unusual specifications.

Photo: Gangloff Cabins AG

At the end of 2012 two Gangloff cabins were delivered to the Val Thorens – Cime de Caron jigback. The convex shape of the all-round laminated glass windows gives the cabins a dynamic touch.

Photo: Gangloff Cabins AG

Two funicular cars were delivered to Bad Wildbad for the Sommerbergbahn in August 2011. The funicular links the centre of Wildbad with the Sommerberg summit, which offers splendid views of the resort and the surrounding hills of the Black Forest.

Photo: Gangloff Cabins AG

In summer 2011 Gangloff Cabins delivered two cars in an Art Nouveau look designed by two Milan architects for the Como – Brunate funicular. The historical funicular links Como with Brunate and offers panoramic views of Lake Como and the Monte Rosa.

Photo: J. Schramm

The Stanserhorn Cabrio is a world first. This fine "Swiss made" project was presented by (left to right) Michael Stähli (Gangloff), Jürg Balsiger (Stanserhornbahn), Reto Canale (IKSS), Marc Pfister (Gangloff) and Istvan Szalai (Garaventa). The aerial tramway with the Gangloff cabins is due to open in May of this year.

First diesel-electric snow groomer worldwide at work in the Alps

The PistenBully 600 E+ on trial at an icey -25°C

The PistenBully 600 E+ can now be seen in the Kauner Valley!

At the beginning of February 2012, customers from Austria, Italy, Switzerland and Germany, and the trade press, not only took a close look at the PistenBully 600 E+ on the Kaunertal Glacier but also had a go at driving it. Kässbohrer Geländefahrzeug AG has had the first diesel-electric PistenBully in operation for several weeks now.

From the study to series production

The PistenBully 600 E+ made its debut as the prototype PistenBully EQ.1 with diesel-electric drive (hybrid drive) at the 2009 Interalpin in Innsbruck, where it set the standard for the industry with regard to sustainable vehicle technology. The PistenBully 600 TwinPower and the PistenBully 600 E+ are two groomers that embody the German company's exemplary commitment to sustainability. The PistenBully EQ.1 was subjected to numerous tests and demonstrated that fuel savings of up to 20 % are possible. The groomer is now available as the PistenBully 600 E+. It meets today's demands for environment-friendly, resource-efficient and above all economical working in this class of vehicle.

Diesel-electric drive with many advantages

Strictly speaking, diesel-electric drives are electric drives with their own power plant in the form of a generator driven by a powerful diesel engine. The electrical energy produced supplies not only the travel motors but also the drive motors for the tiller and winch. This configuration makes the PistenBully 600 E+ a kind of mobile power plant, which can also be used to operate attachments. In comparison to a hydrostatic drive, the same or even a higher level of efficiency is achieved with lower power. An up to 20 % reduction in fuel consumption is a double advantage: On the one hand, it means lower emissions, and on the other hand, running costs are also reduced, which makes the groomer more cost-effective. Moreover, energy recuperation on downhill travel provides power to drive the tiller. From a purely functional perspective, too, the hybrid system offers real advantages: Instead of using a hydraulic drive to power the attachments, they can be operated electrically. That does away with the need for hydraulic pumps and hoses with the associated risk of leakages. The hybrid drive also delivers enough power to operate external electric tools, e.g. for repair work. The new diesel-electric drive was developed in collaboration with external partners and universities.

Groomer tests with a positive response

After the test driving session, operations managers and drivers from ski areas like Kitzbühel, St. Moritz, Alta Badia, Ziller Valley and Steibis in the German Allgäu were asked about their impressions of the new PistenBully 600 E+. The response was clearly positive, especially in comparison with the conventional PistenBully 600.

Quo vadis, OITAF?

Interview with Martin Leitner, President of OITAF

ISR: How do you see OITAF's future agenda?

Martin Leitner: OITAF is the only platform where all three categories – ski areas, manufacturers and authorities – sit down together to discuss and solve current problems confronting the ropeway industry. This discourse on a unique common platform will continue to be of great importance. The purpose of the organization is to promote developments and progress in the whole of the ropeway industry. That involves such activities as the production of guidelines for the planning, construction, operation, maintenance and inspection of lifts and ropeways, and the organization of annual seminars and the International Conference on Transportation by Rope, which is held every six years. The main burden of the work is shouldered by the various OITAF Work Committees.

ISR: What will be the main focus of your work in the fields of ropeway and electrical engineering?

Martin Leitner: The standard is already very high in Europe and America. In Europe especially, the EU Cableway Directive was a big step forward. As a result, OITAF can concentrate on individual aspects (e.g. creation of risk profiles for all types of ropeway, rope lubrication and relubrication, magnetic induction tests for ropes, etc).

ISR: Will you be giving more prominence to such topics as environmental protection and sustainability?

Martin Leitner: Ropeway energy requirements and CO^2 emissions in ski areas are two subjects that are currently under study. And by the way, OITAF's ecological recommendations are all to be found on the OITAF website, where they are also accessible to non-members. Basically, it can be said that aerial ropeways constitute a sustainable mode of transportation; they can be built relatively quickly, offer elegant travel through the air above the natural countryside and are powered by electricity, and recuperation energy from braking is fed back into the grid with a high level of efficiency.

Photo: J. Nejez

Martin Leitner, President of OITAF (left), and Markus Pitscheider (OITAF Secretary General) at the OITAF Congress in Rio, October 2011

ORGANIZZAZIONE INTERNAZIONALE TRASPORTI A FUNE

ISR: Have you defined any priorities for your term of office as OITAF President?

Martin Leitner: One of my primary concerns is to improve the level of ropeway safety in various countries. On some markets there are neither ropeway codes nor any properly trained supervisory bodies. To help those countries we must provide a kind of first aid package containing all the basic information they need. Another item that requires close attention is the large number of old installations in operation worldwide. In this case I intend to appoint an ad hoc working group to draw up a policy document. Another focus will be ropeway noise emissions, a problem that is becoming increasingly critical with the construction of ski area access systems in winter sport resorts and in the light of developments in the field of urban ropeways.

ISR: Do you think OITAF, which is mainly centered on Europe and North America, should pay more attention to other continents, too?

Martin Leitner: One of my aims is to give OITAF a more international orientation. The OITAF Congress in Rio de Janeiro was a first, symbolic step in that direction. It was also an excellent opportunity to show the world that, in addition to mountain resorts, ropeways are an ideal means of transport and traffic problem solver in the urban environment, too. I intend to deepen existing contacts and make new ones with the authorities, operators and manufacturers in the new markets, e.g. in South America, China, South Korea, and the winter sport regions of Eastern Europe. I also hope to integrate these potential members in our organization.

ISR: What is your personal goal as President of OITAF until 2017?

Martin Leitner: OITAF is already very international but I want to make it even more so by recruiting new members. We see considerable potential in South America, Asia and Eastern Europe, as already mentioned. In addition, I am convinced that OITAF can help to make ropeways safer in the more remote countries, not only in terms of planning and construction but also during operation. That is especially important on certain markets where the authorities lack the necessary expertise and the operators are not always equal to the task, either. At the same time we must also make sure we address problems in the Work Committees that are relevant for our established membership in the core markets.

The ISR would like to thank Martin Leitner for the interview.