technet Easy

Power User Meeting 2025 Report

On 20 February 2025, the annual Easy PowerUser Meeting took place at the offices of technet GmbH in Stuttgart.

The meeting is aimed at support and maintenance customers of technet GmbH's Easy software package and offers a platform for exchanging information on current developments and new software functions.

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technet GmbH

technet gmbh

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technet Easy - Power User Meeting

2025 Report

The Easy software package is designed for the end-to-end planning and calculation of membrane and cable mesh structures. It includes various modules for form-finding, statics and cutting pattern generation in textile architecture.

The aim of the meeting was to provide customers with a comprehensive overview of the latest developments, demonstrate their added value and discuss use cases. The meeting was again well attended this year, and there was a lively exchange on the topics presented. The participants showed great interest in the new functions and shared valuable feedback and practical application examples.

The discussion about the possible applications of a digital wind tunnel in particular revealed a broad spectrum of opinions. While some participants expressed great interest in the innovative possibilities, there were also differing opinions regarding the use of a digital wind tunnel in everyday working life. This diversity of perspectives provided a valuable basis for an open dialogue and highlighted both the potential of technology and the existing concerns and challenges.

News in Easy.Static

Bernhard Simmler began the workshop with a presentation of the latest functions in the new Easy.Static structural analysis editor. The following new features were presented:

- Extended visualization options in the graphic: Labelling, contour lines, normals and EC3 design parameters.
- Parallel calculation of load cases using multiple CPU cores.
- Introduction of enslavements for rotation points to define fixed axes in space.
- Enhancements regarding ‘Point and Link’ filters. Editing functions similar to those of the GED program have been added.
- Possibility to calculate and visualize the external loads independently of the load case calculation. This option is particularly useful for pneumatic projects.

The presentation slides are available for maintenance and support customers in the protected download area at www.technet-gmbh.com.

Generation and static calculation of diamond-shaped tunnel meshes

Jürgen Holl then presented a new tool that enables the rapid generation and static calculation of seamless, diamond-shaped tunnel meshes based on user-defined boundary polygons. These meshes are often used for animal passages in zoos or similar structures.

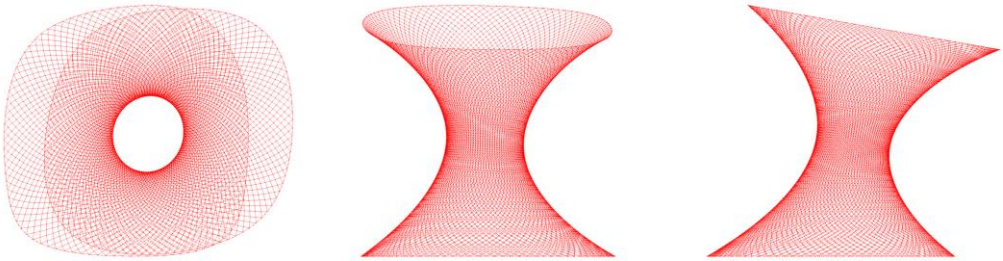


Figure 1: Diamond mesh between two user-defined Nurbs curves

The new tool offers different methods for distributing the horizontal segments equally spaced on the user-defined edge polygons. Depending on the project requirements, users can choose between several approaches to optimize the segmentation for the respective geometry. Various options are also available for the distribution of the mesh points on the discrete edges, allowing flexible and precise customization.

For example, you can arrange the points equally spaced per discrete segment, which is particularly advantageous if certain sections of the boundary polygon require a focused and even distribution of points. Alternatively, the tool offers the option of distributing the points equally spaced across the entire discrete boundary, resulting in a harmonious and continuous mesh. These two methods allow both local detail requirements and global design aspects to be considered equally.

By combining and customizing these distribution strategies, specific boundary conditions and special applications can be optimally addressed so that the resulting network is not only structurally sound but also aesthetically pleasing.

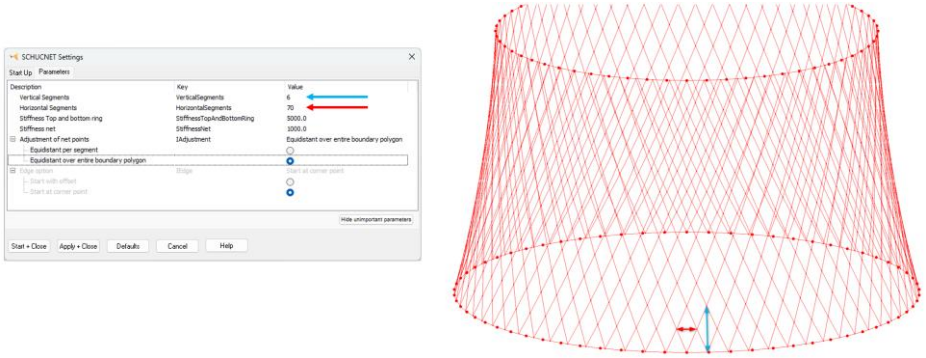


Figure 2: Parameters and output using a simple example.

Examples were used to show how a ‘desired force’ can be generated in the cables by adding or removing segments in a horizontal or vertical direction. By adjusting the segmentation, not only the force distribution within the cables can be optimized, but possible weak points in the cable structure can also be identified and corrected.

Once the static calculation has been completed, it is possible to carry out the cable design directly in Easy.Static in accordance with DIN EN 1993-1-11. This integrated workflow simplifies the planning process considerably, as all necessary calculations and adjustments are carried out in a standardized system.

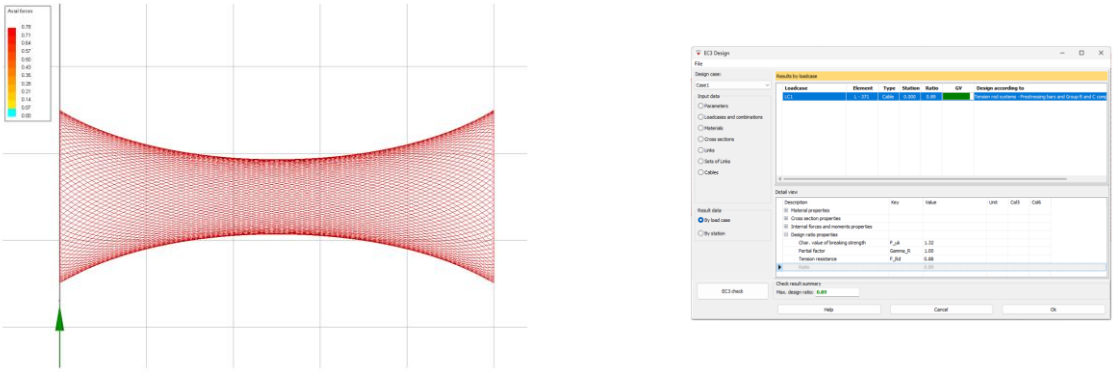


Figure 3: Structural analysis and cable design of a tunnel mesh in Easy.Static

Easy.DWT – Digital wind tunnel

Another highlight was Bernhard Simmler's presentation on simulation in the Easy.DWT digital wind tunnel. He compared the results of simulations with and without wind profiles and emphasized that the cell size at the inlet must not be too large when using profiles to ensure precise modelling. In addition, reference was made to the calculation of the cp values, whereby the reference wind speed should be at the highest point of the model when using profiles. It was discussed that there are currently no standards for numerical simulations, which often leads to challenges with verification engineers.

Design in Easy according to DIN EN 1993-1-1/1-11

Jürgen Holl then gave an insight into Eurocode 3 design in Easy.Static. Firstly, the design of structures with tension members according to DIN EN 1993-1-11:2010-12 was presented in Easy 2025. Subsequently, flexural buckling and lateral-torsional buckling checks were dealt with, whereby both the method with reduction factors and the equivalent imperfection method were addressed. Particular emphasis was placed on how user input is incorporated into the checks and which formulae and chapters are applied in relation to DIN EN 1993-1-1 and 1-11.

Equidistant meshes in FormEdit

Another topic was equidistant meshes and their direct creation on an equilibrium figure in the graphic editor FormEdit.

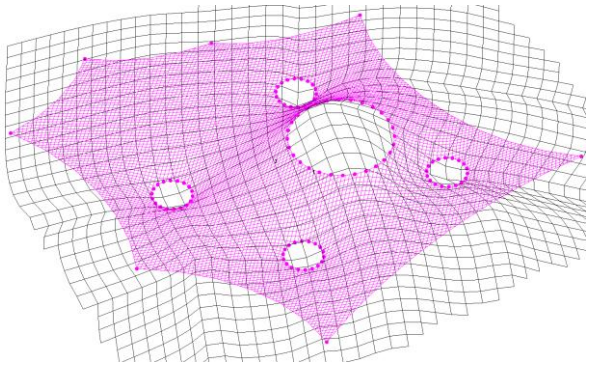


Figure 4: Equidistant mesh on a balanced figure.

technet GmbH is engaged in the calculation of such nets due to the increased demand from customers who have a need for integrated software tools. Engineering offices and cable net manufacturers are increasingly using these nets in areas such as playground structures, fall protection, zoo enclosures and reinforcements for pneumatic structures. Users require integrated solutions that make both the calculation (form-finding and statics) and the creation of cutting plans efficient and uncomplicated.

Another reason for developing such tools is the SOLNet research project. The aim of this project is to develop and build cable net constructions covered with photovoltaic modules, with the energy yield already being integrated into the planning phase. The project is supported by the state of Baden-Württemberg and combines the expertise of technet with cable net manufacturers, photovoltaic specialists and the KIT.

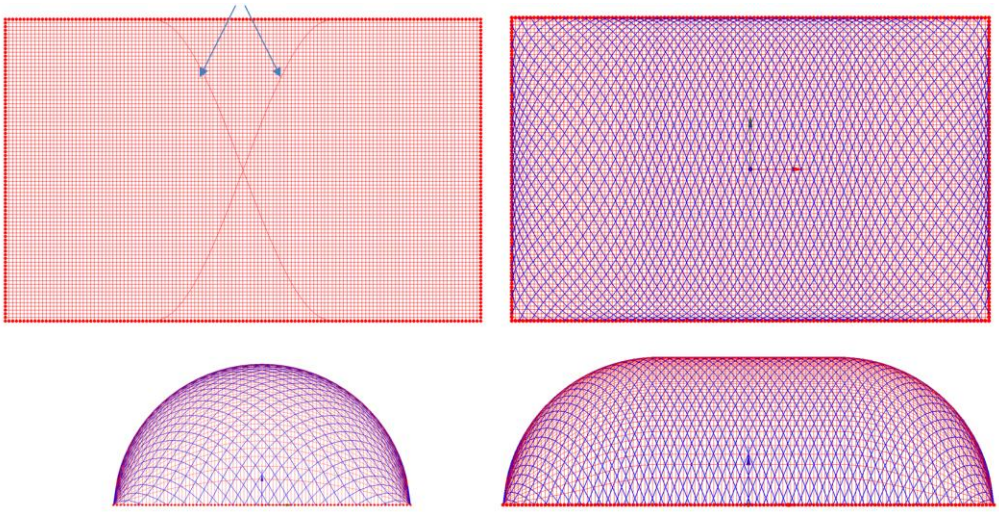
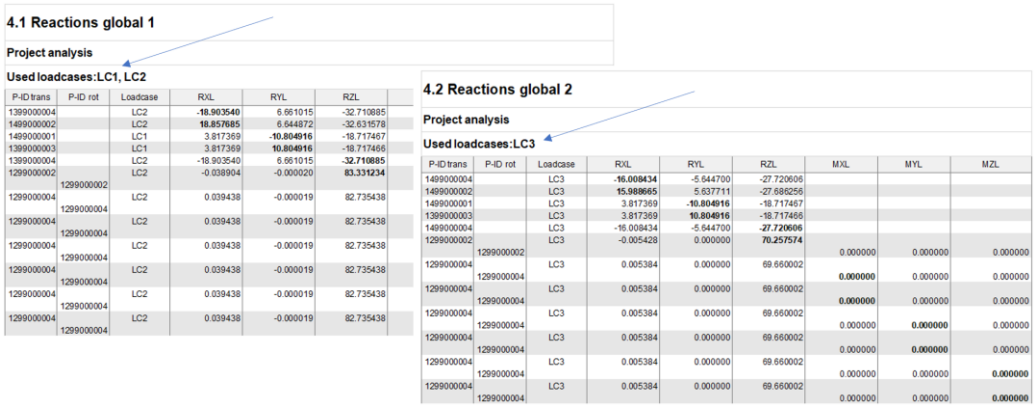


Figure 5: Gas container with an equidistant mesh. The starting lines are geodesic lines.

Report Generator – RepGen

With the delivery of the new Static Editor, the Report Generator has been completely revised. The new options for analyzing projects were briefly discussed. It is now possible to carry out user-defined project analyses, i.e. the user can determine which load cases should be included in the project analysis.



4.1 Reactions global 1

Project analysis

Used loadcases:LC1, LC2

P-ID trans	P-ID rot	Loadcase	RXL	RYL	RZL
1399000004		LC2	**-18.903540**	6.661015	-32.710885
1499000002		LC2	**18.857685**	6.644872	-32.631578
1499000001		LC1	3.817369	**-10.804916**	-18.717467
1399000003		LC1	3.817369	**10.804916**	-18.717466
1399000004		LC2	-18.903540	6.661015	**-32.710885**
1299000002		LC2	-0.038904	-0.000020	**83.331234**
	1299000002				
1299000004		LC2	0.039438	-0.000019	82.735438
	1299000004				
1299000004		LC2	0.039438	-0.000019	82.735438
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1299000004		LC2	0.039438	-0.000019	82.735438
	1299000004				
1299000004		LC2	0.039438	-0.000019	82.735438
	1299000004				
1299000004		LC2	0.039438	-0.000019	82.735438
	1299000004				

4.2 Reactions global 2

Project analysis

Used loadcases:LC3

P-ID trans	P-ID rot	Loadcase	RXL	RYL	RZL	MXL	MYL	MZL
1499000004		LC3	**-16.008434**	-5.644700	-27.720606			
1499000002		LC3	**15.988665**	5.637711	-27.686256			
1499000001		LC3	3.817369	**-10.804916**	-18.717467			
1399000003		LC3	3.817369	**10.804916**	-18.717466			
1499000004		LC3	-16.008434	-5.644700	**-27.720606**			
1299000002		LC3	-0.005428	0.000000	**70.257574**			
	1299000002					0.000000	0.000000	0.000000
1299000004		LC3	0.005384	0.000000	69.660002			
	1299000004					**0.000000**	0.000000	0.000000
1299000004		LC3	0.005384	0.000000	69.660002			
	1299000004					**0.000000**	0.000000	0.000000
1299000004		LC3	0.005384	0.000000	69.660002			
	1299000004					0.000000	**0.000000**	0.000000
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	1299000004					0.000000	0.000000	**0.000000**
1299000004		LC3	0.005384	0.000000	69.660002			
	1299000004					0.000000	0.000000	**0.000000**

Figure 6: Extract from a static report.

Cables on membranes

Dieter Ströbel rounded off this year's meeting with further innovations in Easy.Static. The demonstration first showed how easy it is now to define so-called slip cables. Slip cables can be used to simulate an edge cable 'slipping' in its pocket. The cable then has the same cable force throughout. At the same time, a belt that is 'fixed' to the membrane is defined. The belt has different forces.

Figure 7: Edge cable (left) and belt (right)

In the following, various methods were presented for integrating cables that run on or under membrane and ETFE surfaces into a holistic calculation. The interaction between the membrane and a cable mesh is complex, as the geometric compatibility conditions must be observed and the exchange of cable forces and membrane stresses must be formulated correctly. Here, the software must be able to calculate these deformations in a coupled manner and provide an accurate prediction of the displacements, cable forces and membrane stresses.

An input dialogue has been implemented in Easy.Static for quick model creation. It is now quite easy to integrate the cables on or under the surface into the static model, either freely or sliding in a pocket.

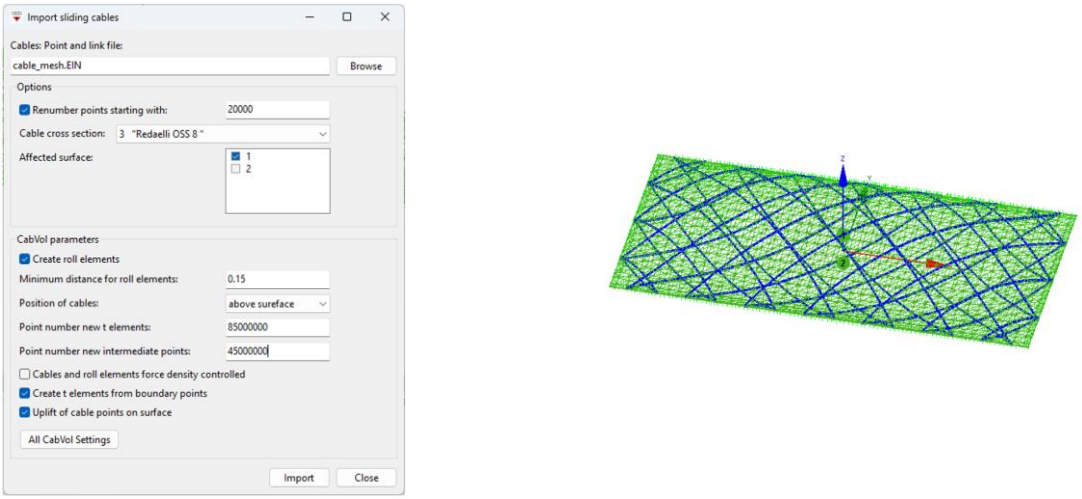

Figure 8: Import dialogue and sliding cables on an ETFE cushion.

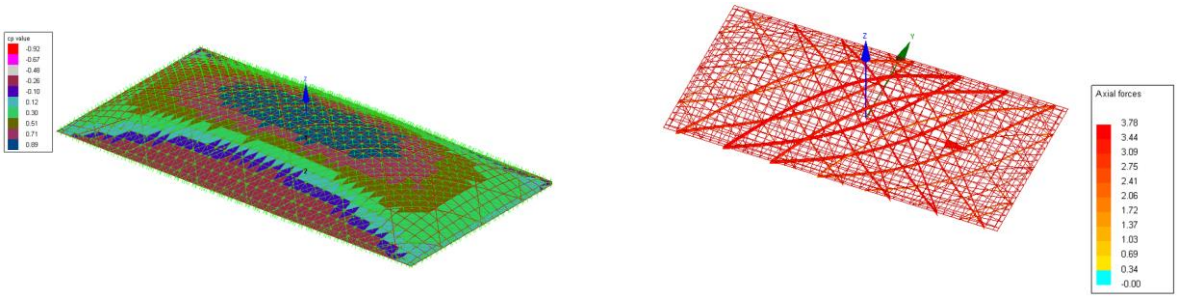

Figure 9: Cushion with cable net on upper and lower foil for a wind load case considering the gas law.

Contact between membrane surfaces

Another topic was the contact problem between membrane surfaces and its influence on the calculation of a pneumatic multi-chamber system, for example in biogas plants. The contact between the outer and inner membrane was demonstrated for the case of wind loads using an example. Contact mainly occurs when the gas membrane is fully loaded with the maximum gas volume.

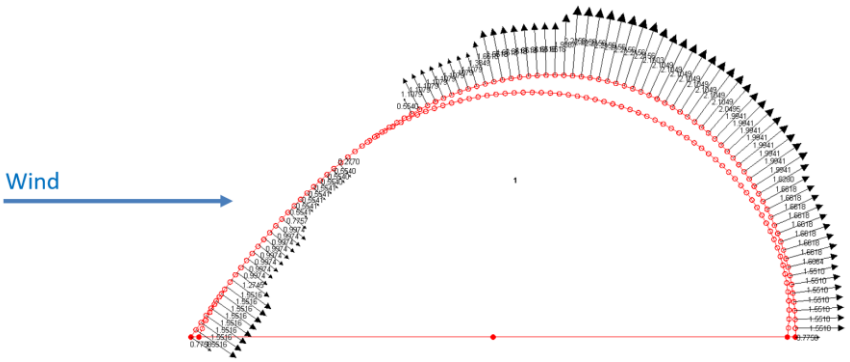

Figure 10: Section through a double-membrane gas holder with wind loads.

Precise modelling of the contact between membrane surfaces is crucial in order to correctly determine the actual air and gas volume in textile structures. If the contact is accurately taken into account, contact points, overlaps and potential deformations of the membranes can be recorded more precisely. This creates a realistic model of the existing gas space, which in turn is essential for calculating internal pressures.

The gas law, which describes the relationship between pressure, volume and temperature, reacts very sensitively to deviations in volume. An inaccurate determination of the effective gas space - for example by modelling the contact zones too roughly - can lead to considerable errors in the pressure calculation. Particularly in safety-relevant applications, it is therefore extremely important to model the contact behavior as precisely as possible. This not only ensures the technical accuracy of the calculations but also contributes significantly to the stability and reliability of the entire design.

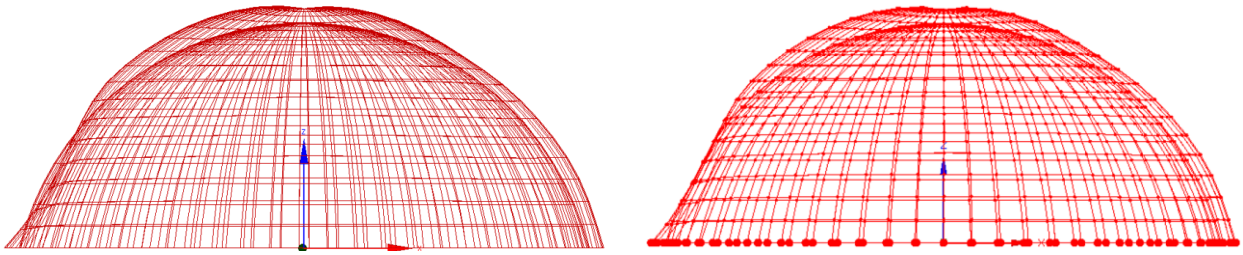

Figure 11: Self intersecting chamber system (left), chambers with consideration of the contact (right)

The consideration of the contact between membrane surfaces in the static calculation is a complex task that requires both precise mathematical modelling and robust numerical methods. These challenges are central to realistically representing the actual mechanical behavior of textile structures.

Water loads and buoyancy

Finally, the new options for considering water loads (buoyancy) and their effects on the calculation results were explained. Dr. Stroebel paid particular attention to demonstrating and comparing the effects of using conservative and non-conservative water loads.

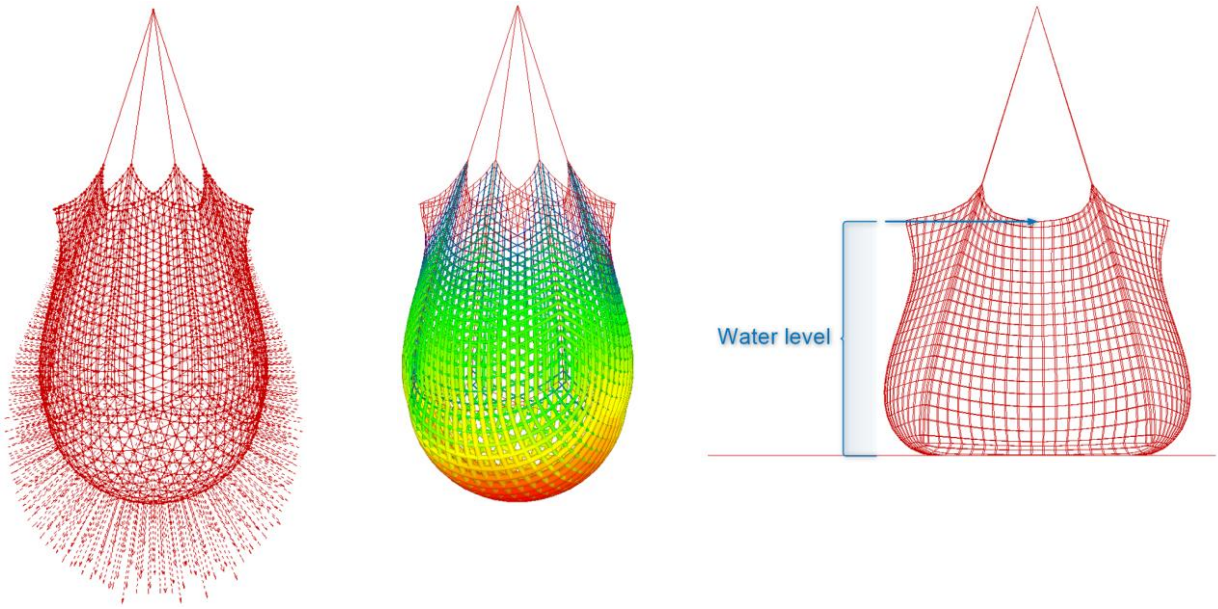

Figure 12: Water-filled water bag and non-conservative external loads (left), membrane stresses (center), water bag (filled) with contact on horizontal surface (right)

The open and constructive atmosphere helped to gather important ideas for the further development of the software and to outline possible next steps together.

We would like to thank all participants for the lively discussions and are already looking forward to the next Easy Power User Meeting!

J. Holl, Stuttgart 02/2025