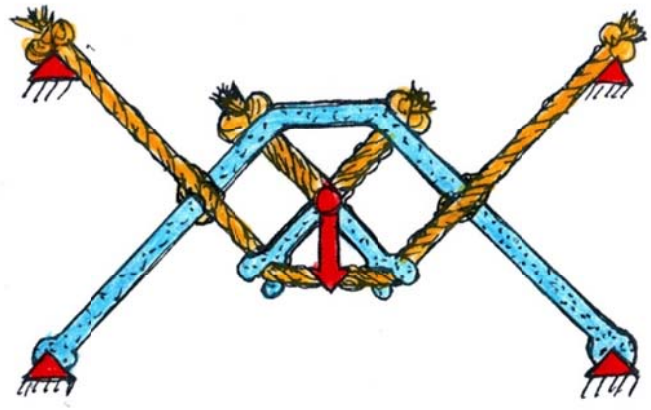
Light and Solid Even Without Computers

Force Cone Method Helps to Design Shape-optimized Components



Shape designed by the force cone method. (FIgure: KIT)

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At Karlsruhe Institute of Technology, a new method for shaping and optimizing the design of technical components in terms of light weight and strength has been developed, which does not need any computers and formulas. The force cone method represents a purely graphical design tool for large enterprises and small trades or for use in natural science lessons. Expensive software licenses are no longer needed.

“In the 1990s, we developed the Soft Kill Option SKO, a method for the design of lightweight and still strong components,” explains Professor Dr. Claus Mattheck, head of the Biomechanics Division of the Institute for Materials Research II of Karlsruhe Institute of Technology. “This method was modeled on phagocytes that remove superfluous parts of bones. Non-carrying sections were eliminated. The remaining section is the framework proper that carries the weight.”

Since then, various types of the Soft Kill Option have been used by industry. Apart from the corresponding software, it requires high computation powers. Now, this method shall be replaced by a computer-free tool, the “Force Cone Method”.

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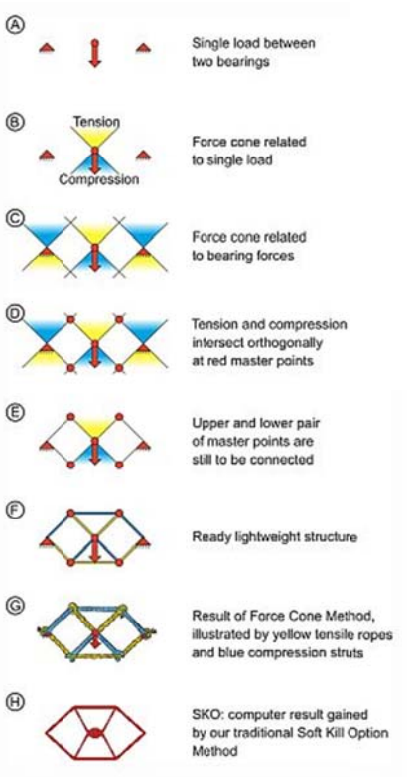
”The basic idea is that in elastic space, a 90-degree compression cone is pushed and a tension cone is pulled by any force,” describes Mattheck his new method. “The input data are the load and the fixations of the future component, which result from its function.”

Construction with the Force Cone Method starts with the user drawing the compression and tension cones. At the points, at which tension and compression beams of these cones intersect orthogonally, mostly at the cone edges, so-called master points are located. These are preferred connection points of compression struts and tension ropes, of which the component is composed.

From the drawing with ropes and struts, even the layman without any mechanical knowledge can derive the force flows. This makes the tool interesting for teaching and formula-free design.

Comparative calculations with the SKO method were in impressing agreement with the graphical results of the Force Cone Method.



Karlsruhe Institute of Technology (KIT) is a public corporation and state institution of Baden-Württemberg, Germany. It fulfills the mission of a university and the mission of a national research center of the Helmholtz Association. KIT focuses on a knowledge triangle that links the tasks of research, teaching, and innovation.

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