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Mechanik-Seminar

Referent:	**PD Dr. habil. Alexander Konyukhov**
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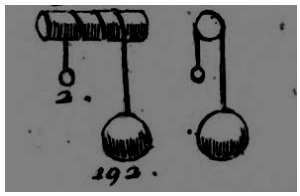
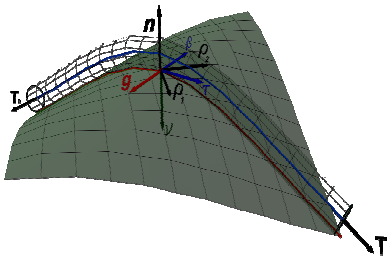
Datum:	Donnerstag, 07.11.2013
Uhrzeit:	15:45-17:15 Uhr
Ort:	Hertz-Hörsaal, Geb. 10.11
Thema:	**Mechanics of curves laying on orthotropic rough surfaces**

Abstract

Mechanics of 1D geometrical manifolds such as curves has attracted a lot of researchers since many years. Depending on mechanical properties, a curve can represent either a beam model, or a rope model. A curvilinear beam model, known as Euler Elastica originally published in 1744, has been developed in various aspects through numerous publications. Another problem is the definition of frictional forces in a rope sliding over a cylinder. The solution of this problem was reported by Euler in 1769 [1] and became known later as Euler-Eytelwein formula [2]. Though, the problem has many engineering aspects, there are only a few publications and developments devoted to this famous problem.

The current work is proposing the consistent theory for contact between ropes and orthotropic rough surfaces based on the recent understanding of contact as the geometrical interaction between various objects (surfaces and curves) inherited with certain mechanical properties (various interface laws).





The variational equations for the equilibrium of ropes on surfaces are derived using the consistent variational inclusion of contact constraints via Karush-Kuhn-Tucker conditions expressed in the Darboux basis. The sticking-sliding frictional conditions on a surface are considered for generalized orthotropic Coulomb's law separately for pulling and dragging direction of a rope.

Surprisingly, closed forms solutions are still possible – several cases are discussed in detail including the criteria of static equilibrium, – and the famous Euler-Eytelwein formula $T = T_0 e^{\mu\Phi}$ for tensile forces in the rope wrapped around the cylinder is recovered. The theorem – **The equilibrium curve on a rough surface under maximum tensile load is a geodesic** – is easily resulting as an outcome of the developed theory.

[1] Euler L., Remarques sur l'effet du frottement dans l'equilibre, Memoires de l'academie des sciences de Berlin, 18, 1769, pp. 265–278.

[2] Eytelwein J. A., 1808. Handbuch der Statik fester Körper. Mit vorzüglicher Rücksicht auf ihre Anwendung in der Architektur. Vol. 2, Berlin, pp. 21–23.

[3] Konyukhov A., 2013. Contact of ropes and orthotropic rough surfaces. Accepted for publication in Zeitschrift für Angewandte Mathematik und Mechanik.

Alle Interessenten sind herzlich eingeladen.
Prof. Dr.-Ing. Peter Betsch