数学与系统科学研究院

计算数学所学术报告

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报告题目：

Evolution and Verification of a Kinematic Hypothesis for Splitting of the Strain Energy

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上午 **10:00-11:30**

报告地点： 数学院南楼五层

514 教室

Abstract：

Splitting of the strain energy into its "non-membrane" and membrane percentage provides insight into the load-carrying mechanism of structures, subjected to proportional loading. It may be useful, for example, for sensitivity analysis of the initial post-buckling behavior of beams, arches, plates, and shells, and assemblies of such structures. The task of this work is to determine this percentage without computing insignificant numbers such as the values of the strain energy and its membrane part. It is hypothesized that this percentage is proportional to the acceleration of a fictitious particle, moving along a curve on the unit sphere. The curve is described by the vertex of the normalized "fundamental eigenvector" of the so-called "consistently linearized eigenvalue problem". The proportionality factor is obtained from the initial condition for the "non-membrane" percentage of the strain energy, hypothesized as twice the initial velocity of the particle. The lower bound of this factor signals the constancy of this percentage with increasing load, whereas the upper bound predicts its monotonic increase. The proof of the universal validity of the two hypotheses begins with their verification for the special cases of a membrane stress state and pure bending. The assertion that this is a sufficient condition for the universal validity of these hypotheses is subsequently verified for an example with a monotonically increasing "non-membrane" percentage of the strain energy. It is finally confirmed by an indirect proof of their validity for a non-monotonic course of this percentage. A by-product of this work are conditions for extreme values of the stiffness of structures, subjected to proportional loading.

Herbert Mang 简介：

赫伯特·芒主要研究结构工程和计算力学；1977 年他与 Gallagher 教授（国际公认的有限元法开创者之一）一起，揭示了杂交位移法的数值不稳定性。之后，相继创造性地发展了边界元法的奇异积分技术；理论上澄清了冷却塔等结构的稳定性和失效破坏机理，推动了相关结构设计思想的转变；并在多场与多尺度方法及其应用方面有重要建树；是结构工程和计算力学界国际公认的学术权威，

赫伯特•芒的杰出成就和贡献使其获得多国和多个国际组织的奖励总计 16 项：1996 年获奥地利政府的威廉埃克斯纳奖章；2002 获奥地利科技界最高荣誉—科学与艺术荣誉十字勋章；2004 年以其姓氏"Mang"命名了一颗小行星，等等。1992 年当选奥地利科学院院士，曾任奥地利科学院院长，并陆续当选欧洲科学院、美国工程院等 18 个国家或地区的院士或外籍院士。

赫伯特•芒 1981 年以联合国特派专家身份，来华对世银资助项目—"大型计算机主机建设"提供了宝贵支持，并在西安、北京进行了有限元法讲座，对中国结构工程计算的进步做出了重要贡献。此后，他访问中国的频率逐渐增加，和国内高校及科研机构建立了广泛的合作关系。先后指导中国十余名研究生和访问学者。

1995 年入选为中国工程院外籍院士。

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