SEMINAR SERIES

北京大学工学院 先进制造与机器人系

R2G Adhesive Metamaterials Toward Robotic Applications: Overcoming the Conflicts and Breaking Through the Scaling Limits in Gecko and Gecko-Inspired Adhesives

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汇报内容简介：

Inspired by the sophisticated fibrillar adhesive microstructures of geckos, smart dry adhesives are now widely used in household, agricultural, and industrial applications. They offer strong adhesion when required and easy detachment when desired. However, they are confronted with many trade-offs and limits, including adhesion strength vs. ease/speed of detachment, adhesion strength vs. surface roughness/morphology adaptability, and scaling limits on the fibril/array levels. Mechanical metamaterials, which mimic or extend designs found in nature, are inspiring humans to design new materials and structures with unconventional properties. Gecko and gecko-inspired adhesives, with their ingenious microstructures, can be regarded as metamaterials. However, with the aid of mechanical design tools, humans can push these designs beyond what is available in nature. On the other hand, smart materials, such as shape memory polymers (SMPs), exhibiting tunable material properties during the Rubber-to-Glass (R2G) phase transition process, are empowering humans to develop novel devices and applications. Combining the advanced mechanical designs in metamaterials and unusual properties of SMPs, we can have smart R2G adhesive metamaterials which show great potential in addressing the aforementioned trade-offs and scaling limits. Herein, we briefly review recent advances on adhesive metamaterials with an emphasis on new trends in using metamaterials to extend the workspace of smart adhesives. Moreover, we will present recent work in our group where the adoption of SMPs combined with structural designs are used to develop strong, switchable, and scalable R2G smart adhesives to overcome the adhesion paradox and switchability conflict on rough surfaces and to break through the scaling limits of fibrillar adhesives, as well as the application of these strong R2G adhesives in robotics.

报告人简介：

令狐昌鸿，新加坡南洋理工大学博士后研究员。浙江大学工程力学学士（导师王高峰教授）、浙江大学固体力学硕士（导师宋吉舟教授）、新加坡南洋理工大学机械与宇航学院固体力学博士（导师夏焜教授和高华健教授）。主要从事智能界面粘附力学及其应用研究。研究工作主要基于界面力学/物理/化学，利用智能材料可调特性，揭示不同条件下界面粘附强度强弱控制的机理，探索界面粘附强度调控规律，并基于此研发自适应界面粘附系统，集成并应用于机器人、机械手、无人机、可穿戴柔性电子器件、微纳组装、3D打印、医疗、超材料等领域。拥有中国国家发明专利10项，实用新型专利8项；于Elsevier发表专著章节一章；在*JMPS*、*EML*、*IJSS*、*Science Advances*、*Nature Communications*、*PNAS*、*National Science Review*、*npj Flexible Electronics*、*Soft Matter*等期刊上发表SCI论文20多篇，H 因子14，引用830。

主持人：刘珂 研究员（北京大学工学院先进制造与机器人系）

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地　点：北京大学工学院 1 号楼 210

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