数学与系统科学研究院

计算数学所学术报告

报告人：**Prof. Yasumasa Nishiura**

（ *Tohoku University* ）

报告题目：

Bridging a mesoscopic inhomogeneity to macroscopic performance of amorphous materials in the framework of the phase field modeling

邀请人： 许现民 副研究员

报告时间：**2020** 年 **1** 月 **10** 日（周五）

下午 **16:00-17:00**

报告地点： 数学院南楼二层

224 教室

Abstract:

One of the big challenges in materials science is to bridge microscopic or mesoscopic properties to macroscopic performance such as fracture toughness. This is particularly interesting for the amorphous materials such as epoxy resins because their micro/meso structures are difficult to characterize so that any information connecting different scales would be extremely useful. At the process level, the polymerization rate can be changed experimentally that influences a lot over the performance of materials, however, it is known that the maximum toughness does not always appear at the maximum polymerization rate, which suggests that some differences in the micro/meso-scopic structure affect the macroscopic property behind. The goal of my talk is to present a framework to bridge a mesoscopic observation of X-ray CT and the criterion of fracture toughness, which is computable in the framework of the phase field modeling. First we classify the data of the X-ray image with different polymerization rate by using two different methods: one is SVD and the other is persistent homology. Secondly we compute a crack propagation of each sample and evaluated a scalar value called the effective toughness (ET) via J-integral, which is one of the good candidates indicating a toughness of material. It turns out that ET reflects the performance of each sample and consistent with the experimental results. There remains many open problems and my presentation is the first step toward our final goal. This is a joint work with Edgar Avalos, Shuangqaun Xie, and Kazuto Akagi of Tohoku University.

Bio:

Yasumasa Nishiura is Specially Appointed Professor of mathematics at Tohoku University's WPI-AIMR(Advanced Institute for Materials Research). He is the recipient of the Autumn Prize of Mathematical Society of Japan in 2002 and received the Prize for Science and Technology of the Commendation for Science and Technology by the Minister of Education, Culture, Sports, Science and Technology in 2012. He is also an invited speaker at ICIAM 2015. Nishiura's work focuses on the dynamics of dissipative structures from the dynamical system point of view, in particular, the interplay between intrinsic and extrinsic instabilities of localized patterns including collision, splitting, destruction, and adaptive response to external environments. He is also interested in a topological approach to materials science after moving to WPI-AIMR at Tohoku University. He serves as an editor of Physica D, SIAM J. Appl. Dyn. Sys., SIAM MMS, CHAOS (2008-2013), and European Journal of Applied Mathematics (2005-2010).

欢迎大家参加！