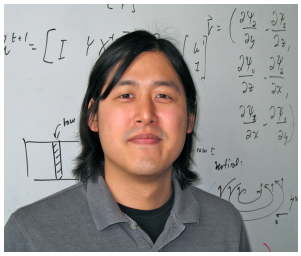
The University of Chicago Computer Science Department
PRESENTS:

“Non-Linear Eigenstructures in Computer Animation”



Theodore Kim
Pixar Animation Studios

Abstract:
Non-linearity lies at the heart of many visual phenomena in computer graphics, including muscles, flesh, fire, and water. In this talk, I will present my recent work on gaining a better understanding of physical and numerical properties that underpin several of these phenomena.

In order to realistically simulate skin and flesh, highly non-linear equations must be solved. The underlying behavior of these equations, i.e. their eigenstructures, are usually difficult to ascertain, and they are mostly only probed numerically. I will show that these equations can in fact be understood using a set of clean and compact analytic expressions. The core of this approach is the use of eigenmatrices, which reveal structures that are not visible with traditional eigenvectors. This approach yields fast, compact, and robust algorithms that have been used in the movies *Cars 3, Incredibles 2*, the short film *Bao*, and the upcoming *Toy Story 4*.

Additionally, I will show that the non-linear equations that govern the motion of water, smoke, and fire can also be written in terms of analytic eigenstructures, and that doing so allows us to generate supernatural fluid motions. Taken together, these techniques point the way towards more sophisticated numerical methods, increasingly realistic physical models, and novel aesthetic phenomena.

Bio:
Theodore Kim is a Senior Research Scientist at Pixar Animation Studios, where he investigates biomechanical solids, fluid dynamics, and selected topics in geometry. Previously, he was an Associate Professor at the University of California, Santa Barbara, in Media Arts and Technology (MAT), and Computer Science (CS). He is the recipient of the NSF CAREER Award, two Best Paper awards, and a Scientific and Technical Academy Award (SciTech Oscar).

Thursday, March 14, 2019
2:00 pm
JCL 390
Host: Fred Chong