Mathematics & Computer Science Colloquium

Present:

Darren E. Mason

Associate Professor of Mathematics
Mathematics and Computer Science
Albion College
Albion, MI

Speaking on:

What if my paper clip was made out of NiTi?

Shape memory alloys (SMAs) are fascinating structures in materials science and engineering. Fundamentally, these are materials that are formed at a high temperature and then allowed to cool. Once at a lower temperature (often room temperature), SMAs can be bent and twisted into heavily deformed shapes that appear to be permanently damaged. However, the material has instead reorganized itself crystallography at an atomic level in a reversible fashion. Moreover, upon reheating, the alloy "remembers" its original atomic configuration and can return to it almost instantly. This transformation is viewed by the naked eye as a return to its original formed shape. This microstructural change is an example of a common phenomenon in mechanics and materials science called "phase-transitions." The theoretical study of such material reconfigurations is typically conducted mathematically using the machinery of variational calculus with a view towards material energy minimization. In this talk we will provide a physical overview of the fundamental behavior of SMAs as well as discuss the basic mathematical framework used to predict such transitions. In the end, it is all about optimization.

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