Applied Numerical Computing for Multimedia Applications CS4390 - CS5390 Spring 2025 Instructor: Dr. Chr. Lauter

How you ever wondered...

- ... how a computer can do 2048bit RSA encryption when its label only says 64bit CPU,
- ... what could go wrong with numerical applications and what did go wrong in history,
- ... how Numerical Weather Forecast works and why it is never accurate after a week out,
- ... how Magnetic Resonance Imaging can produce an image of the inside of your body,
- ... what the word *interpolation* in your photo camera's description actually means,
- ... how MP3 audio compression works,
- ... how much 5G mobile phone service depends on really fast computing at low power,
- ... how we can exploit the 8 cores of our CPU or how we can program a supercomputer, or
- ... how Amazon/Facebook/Google/Netflix/Hulu/et al. knows your preferred movies?

Then enroll into Applied Numerical Computing for Multimedia Applications!

This course introduces students to fundamental concepts in Numerical Computing such as:

- Representation of integer numbers and computation with integers on thousands of bits
- Representation of real numbers as Floating-Point Numbers and the issues with this representation
- Basic numerical Linear Algebra and its applications to Scientific Computing
- Polynomial interpolation and evaluation and their use in measurement data manipulation
- Basic Signal Processing
- Introduction to Fourier transforms and its application in audio processing
- Basic parallel computing with OpenMP and MPI
- Basic dictionnary learning and the underlying advanced Linear Algebra Concepts
- Basic numerical image processing techniques.

All concepts are directly showcased with real-life applications.

Students interested in enrolling in this course should have basic experience with programming in C and/or Python. Besides general education in Mathematics, the course does not have more particular requirements; students should not be allergic to maths, though.

Please do not hesitate to contact Dr. Chr. Lauter with questions: cqlauter@utep.edu or 915-747-5939.