

APS Scientific Computation Seminar Series

Speaker: Franz Franchetti
Kavcic-Moura Professor, Electrical and Computer Engineering
Associate Dean for Research, College of Engineering
Carnegie Mellon University

Title: SPIRAL: AI for High Performance Code

Date: Monday, September 27, 2021

Time: 1:00 p.m. (Central Time)

Location: [Microsoft Teams meeting](#)
Join on your computer or mobile app
[Click here to join the meeting](#)
Or call in (audio only)
[+1 630-556-7958, 423448001#](#) United States, Big Rock
Phone Conference ID: 423 448 001#
[Find a local number](#) | [Reset PIN](#)
[Learn More](#) | [Meeting options](#)

Hosts: Mathew Cherukara and Nicholas Schwarz

Abstract: This talk provides a current and comprehensive overview of the SPIRAL system, that has been developed over 20 years at Carnegie Mellon University, and is now available as BSD Open-Source System. We show that SPIRAL is a rule-based AI system that captures the knowledge of how algorithms, computer architecture, and program transformations are defined and interact. We develop the underlying formal framework to capture computational algorithms, computing platforms, and program transformations of interest, using a unifying mathematical formalism we call operator language (OL). Then we cast the problem of synthesizing highly optimized computational kernels for a given machine as a strongly constrained optimization problem that is solved by a multi-stage rewriting system. Since all rewrite steps are semantics preserving identity operations, our approach allows us to formally prove the equivalence between the kernel specification and the synthesized program. Finally, we present a first look at FFTX and SpectralPack. We aim at translating the LAPACK/BLAS approach from the numerical linear algebra world to the $N \log N$ /spectral algorithm domain.