

# Teaching PROFESSOR New Math

*Wednesday, 11 July 2018 12:30 (15 minutes)*

We present a range of conceptual improvements and extensions to the popular tuning tool “Professor”.

Its core functionality remains the construction of multivariate analytic approximations to an otherwise computationally expensive function. A typical example would be histograms obtained from Monte-Carlo (MC) event generators for standard model and new physics processes.

The fast Professor model then allows for numerical optimisation in a number of different contexts such as chi-square minimisation and likelihood evaluation.

Previously, Professor was based on ordinary polynomials. Those, albeit highly successful, showed limitations whenever the true functional form exhibited some form of  $1/x$  behaviour (e.g. due to masses in propagators). We describe our efforts to replace the polynomials with rational, or “Pade”, approximations as well as radial basis functions (RBF).

Further, we introduce a new and better optimization routine that replaces the gradient-based optimization inside Professor by an RBF-based approach that can be shown to generate superior parameter fits.

We illustrate our improvements for the task of MC-generator tuning and limit setting.

**Primary authors:** Dr SCHULZ, Holger (Fermi National Accelerator Laboratory); Dr AUSTIN, Anthony (Argonne National Laboratory); Prof. LEYFFER, Sven (Argonne National Laboratory); Dr MRENNNA, Stephen (Fermi National Accelerator Laboratory); Dr MUELLER, Juliane (Lawrence Berkeley National Laboratory)

**Presenter:** Dr SCHULZ, Holger (Fermi National Accelerator Laboratory)

**Session Classification:** T2 - Offline computing

**Track Classification:** Track 2 –Offline computing