Yakov Ben-Haim[1] and François Hemez[2], 2020, Richardson extrapolation: An info-gap analysis of numerical uncertainty, ASME *Journal of Verification, Validation and Uncertainty Quantification,* vol.5, number 2, article 021004, pp.1–8.

Abstract Computational modeling and simulation is a central tool in science and engineering, directed at solving partial differential equations for which analytical solutions are unavailable. The continuous equations are generally discretized in time, space, energy, etc., to obtain approximate solutions using a numerical method. The aspiration is for the numerical solutions to asymptotically converge to the exact-but-unknown solution as the discretization size approaches zero. A generally applicable procedure to assure convergence is unavailable. The Richardson extrapolation is the main method for dealing with this challenge, but its assumptions introduce uncertainty to the resulting approximation. We use info-gap decision theory to model and manage its main uncertainty, namely, in the rate of convergence of numerical solutions. The theory is illustrated with a numerical application to Hertz contact in solid mechanics.

Keywords Richardson extrapolation, rate of convergence, numerical approximation, uncertainty, info-gaps, info-gap decision theory.

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[1]Yitzhak Moda'i Chair in Technology and Economics, Technion—Israel Institute of Technology, Haifa, Israel. yakov@technion.ac.il

[2]Lawrence Livermore National Laboratory, Design Physics Division, Mail Code 170, 7000 East Avenue, Livermore, California 94550, hemez1@llnl.gov