

Error Control B-spline Gaussian Collocation PDE Software  
with Time-Space Event Detection

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This report introduces BACOLIKR, a new event detection software package for the error controlled numerical solution of systems of one-dimensional time-dependent partial differential equations (PDEs). BACOLIKR employs B-spline Gaussian collocation for the spatial discretization in a spatial error control framework. A novel feature of this package is that it allows the user to specify solution dependent conditions that are used to determine a point in time when the specified time and space dependent event occurs. The event detection capability in BACOLIKR is based on its use of a modified version of the time integrator, DASKR, which implements time-dependent event detection as well as providing temporal error control. BACOLIKR was developed through major modifications of the error control PDE solver, BACOLI, and the DASKR package. This report first provides an overview of the BACOLI and DASKR packages and then describes the software modifications required in order to develop BACOLIKR. The rest of the report investigates the application of BACOLIKR to solve a number of PDE-based event detection problems including solution layer-boundary intersection detection and solution layer merge detection in fluid mechanics models, critical tumor mass detection in a brain tumor model, steady state detection in the Cahn-Allen equation and the Gierer-Meinhardt model, and boundary event detection for a heat flow model.