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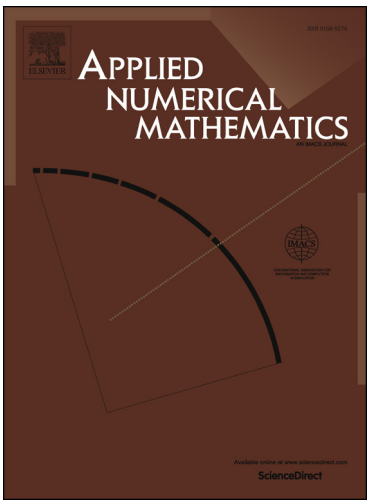

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Shooting methods for state-dependent impulsive boundary value problems, with applications

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Abstract

For impulsive boundary value problems whose solutions encounter discontinuities (jumps) at a priori not known positions depending on the solution itself, numerical methods have not been considered so far. We extend the well-known shooting approach to this case, combining Newton iteration with the numerical solution of impulsive initial value problems. We discuss conditions necessary for the procedure to be well-defined, and we present numerical results for several examples obtained with an experimental code realized in MATLAB.[1]

Keywords: nonlinear boundary value problems, state-dependent impulses, shooting method
2000 MSC: 34B15, 34B37, 65H10, 65L10

1. Problem setting: impulsive boundary value problems (BVPs)

Impulsive problems are characterized by the occurrence of abrupt changes of their solutions. In real word problems, the impulses often do not occur at fixed times, but the positions of their appearance depend on the state and situation of a differential model. The corresponding impulse conditions are

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