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Higher order zero time discontinuity mapping for analysis of degenerate grazing bifurcations of impacting oscillators

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Abstract: The discontinuity mapping technique provides quite a good way to study the near-grazing dynamics in the impacting oscillators. However, disagreements between the results obtained by the discontinuity mapping technique and the direct numerical observations still exist in terms of modeling and stability analysis. In particular, when applying the existing theory to deal with the complicated degenerate or other co-dimension two grazing bifurcations, even potential mistake in the qualitative analysis might arise. To reduce such disagreements, the local zero time discontinuity mapping is extended to higher order terms for the generic multi-degree-of-freedom impacting oscillators under harmonic excitation in this paper. Furthermore, to demonstrate the necessity and feasibility of using the higher order zero time discontinuity mapping for the analysis of degenerate grazing bifurcation, comparisons between the lower and higher order truncation are made through the existence analysis of near-grazing impact periodic motions.

Key Words: Higher order discontinuity mapping; Degenerate grazing bifurcation; Impact periodic motions.

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