On the Accuracy of the Numerical Integrals of Newmark Method for Computing Inelastic Seismic Responses

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ABSTRACT

The method of Newmark $\beta = 1/4$ is the most popular algorithm in numerical integrals for computing seismic responses of inelastic structures. While the algorithm is being used from around forty years before, it does not seem enough to be inspected that the accuracy of the responses computed by the algorithm is valid. Though adopting a sufficiently small interval of time in the algorithm may give convergent responses, it is highly possible that the increment response in the interval of time includes errors related to components of high frequency waves. This is because that the responses diverge when the algorithm adopts the numerical integrals with the stable condition of the interval of time. Namely, the divergence suggests the existence of components of high frequency.

The paper proposes an algorithm of a numerical integral clearly removing components of high frequency waves from the responses. Comparing the results given by the proposed method with that by the direct solution with Newmark $\beta = 1/4$ indicates that the latter results have errors if a seismic wave includes any small components of wave with shorter period than the interval of time in the algorithm.

REFERENCES