Title: Development of effective code for earthquake dynamic source simulations

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Abstract: Dynamic rupture modeling coupled with strong motion data fitting offers an insight into physical mechanisms behind earthquake sources [Gallovic et al., 2019]. Running a large number of dynamic model simulations is required due to the nonlinearity of the inverse problem. The goal of this Thesis is a development of an efficient forward solver for the dynamic inversions. The finite difference staggered grid code FD3D by Madariaga and Olsen [1998] served as a basis for the development, offering sufficient speed, but rather low accuracy. Traction at split node implementation of the fault boundary condition and perfectly matched layers as the absorbing boundary condition were required to obtain desirable accuracy. In addition to the slip weakening friction law, fast velocity weakening friction law has been implemented, increasing the applicability of the code. We test the new code FD3D_TSN using USGS/SCEC benchmarks TPV5 (slip-weakening friction) and TPV104 (fast rate weakening friction) [Harris et al., 2018], showing very good agreement with results calculated by advanced numerical codes.

Keywords: Earthquakes, Finite differences, Dynamic rupture simulation, Earthquake source