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Supersonic propagation of frictional sliding

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Supersonic propagation of shear cracks/ruptures along the fault has been reported in the literature to be observed in the field in laboratory. Here we consider a mechanism of supersonic propagation sliding zone based on the elasticity of the rock surrounding the discontinuities or faults. We notice that sliding of every element of the rock at the fault surface creates normal (tensile/compressive) stresses in the neighbouring elements on the planes normal to the fault. Behaviour of these elements is controlled by their elastic properties, in particular the rock elastic modulus. We show that in the case of constant friction the rock elasticity makes the sliding zone propagate with the p-wave velocity of the rock. We also demonstrate that the rate dependence of friction can reduce wave velocity still leaving it higher than the s-wave velocity thus making it intersonic.