

## **Evolutions of Friction Anisotropy and Heterogeneity**

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Besides surface roughness changes during friction, material sliding surfaces may be subjected to evolution and reorientation of their microstructures. For instance, complex kinematics of sliding initiate microstructural and frictional changes in some polymers and in layer-lattice materials as graphite and molybdenum disulphide. Advanced friction models can describe evolutions of frictional anisotropy and heterogeneity induced by the sliding kinematics. Due to this, first-, second- and higher-order descriptions of friction are developed with respect to powers of the sliding path curvature. The proposed friction equations are in conformity with the objectivity axiom and the Second Law of Thermodynamics. The sliding path curvature generates: (a) additional resistance to sliding (dissipative type forces), (b) constraint forces normal to the sliding path (gyroscopic type forces). It can induce positive and negative additional friction, and it can change essentially the sliding trajectory. Friction cones depend on the sliding path curvature in this case.

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