Constraining local slopes and failure stress from shape models of asteroid pairs

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Pairs of Asteroids had a single progenitor that split in the last $\sim 10^6$ years due to rotational-fission of a weak, 'rubble-pile' structured body. By constructing shape models of Asteroid Pairs from multiple-apparition observations conducted at the Wise Observatory in Israel (Polishook 2014) and by using the lightcurve inversion technique (Durech et al. 2010), we mapped the gravitational and rotational accelerations on the surfaces of these unique asteroids. This allows us to construct a map of topographic slopes on the asteroids' surfaces.
The local slope is defined to be the angle between the inwards surface normal and the local gravity vector including the centrifugal term. In order to test for frictional failure, for each asteroid in the set, we determine the maximum rotation rate at which an area larger than half the surface area of the secondary member (assumed to be the ejected component) has a slope value larger than 40 degrees, the angle of friction of lunar regolith (Mitchell et al. 1974), where a loose body will start sliding. We use this critical state to indicate the location of the failure on the surface of the primary member and to constrain the failure stress operating on the body just before disruption, using the Drucker–Prager failure criterion (Holsapple 2007).
Our current preliminary sample includes 7 primary members of asteroid pairs with diameter range of 3 to 10 km, and diameter ratio range (secondary/primary) of 0.1 to 0.6. Our spun-up models have wide enough areas with high slopes when they reach ~ 2.8 hours, suggesting they disintegrate at this spin, even though it is slower than the 'rubble pile spin barrier'. Assuming this rotation period in the failure criterion, we can place a lower limit on the cohesion for 3 asteroids in our sample, while the other 4 are consistent with a cohesionless body. We will further present the parameter space of our model and discuss its implications.