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Topological Spatio-Temporal Complexity Analysis of an Evolvable Rough Fracture

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We study avalanche patterns of a rough fracture which under a constant normal load is sheared. The development of the opening spaces among top and down halves are measured using a scanner laser. Using the obtained void spaces, apertures rate variations are mapped into the networks patterns. Particularly, spatial and temporal networks over openings with abnormal variation rates (events) are constructed (with having more than 4000 active and non-active nodes). The evolution of events over 20 mm displacement of the fracture shows a power law (slope near -3) behaviour with differentiated patterns corresponding to after and before the onset of the slip. The observed trend is in correlation with the AEs statistical patterns reported for crack/fracture developments/propagation. Also, the patterns revealed in analysis of hierarchical modularity are showing roughly three differentiated patterns, either for spatial or temporal networks. Thus, using a null theory based on random configuration of temporal networks, the possible coupling of spatial and temporal networks are analysed. Then we could analysis the memory effects in evolution of friction. As the final part of our research, we compare our results based on the “point networks” with “profile networks”.