Multi trajectory expansion for the constraint motion of mechanisms

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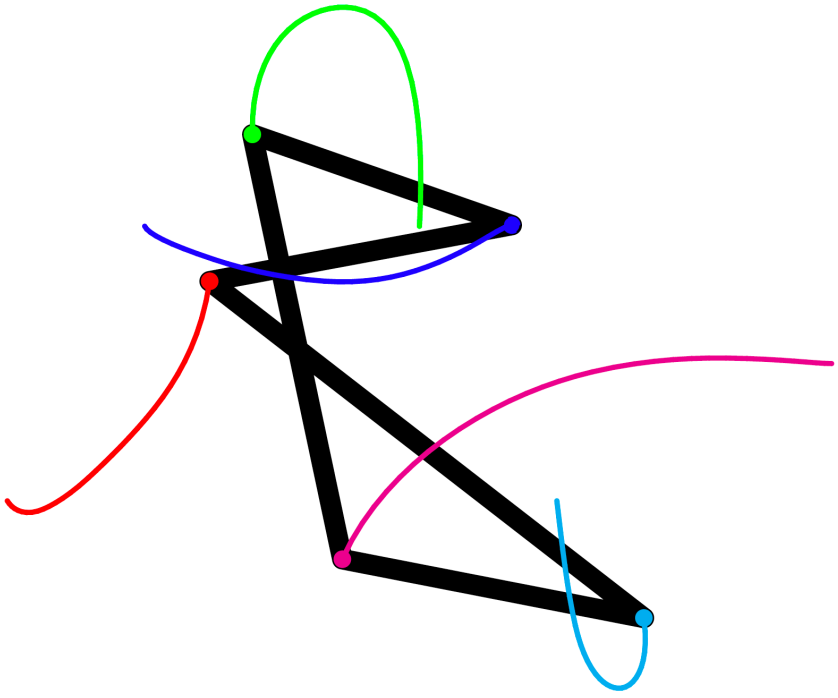
We propose a new technique to describe the internally constrained motion of mechanisms which are assumed to consist of joints connected by rigid linkages. The possible trajectories of the joints are expressed as a power series expansion in time, where the series coefficients of one order are obtained from a recurrence formula which involves all lower orders. This allows for a numerical description of trajectories which are smooth at any instant of the evolution while obeying the constraints up to any desired accuracy. First, we will apply the technique to a purely kinematic evolution of mechanisms, where the motion is optimal in the sense that the series coefficients have the lowest possible Euclidian norm. Then, we will illustrate how to incorporate dynamic processes into the framework by assuming an elastic energy for the mechanisms and computing the trajectories along the corresponding gradient flow.



(Example for possible joint trajectories of a five-bar linkage.)