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Local-to-global principles for rotor walk

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In rotor walk on a finite directed graph, the exits from each vertex follow a prescribed periodic sequence. Here we consider the case of rotor walk where a particle starts from a designated source vertex and continues until it hits a designated target set, at which point the walk is restarted from the source. We show that the sequence of successively hit targets, which is easily seen to be eventually periodic, is in fact periodic. We show moreover that reversing the periodic patterns of all rotor sequences causes the periodic pattern of the hitting sequence to be reversed as well. The proofs involve a new notion of equivalence of rotor configurations, and an extension of rotor walk incorporating time-reversed particles.

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