1172-35-19 **Graeme W Milton*** (milton@math.utah.edu), Department of Mathematics, University of Utah, 155 South 1400 East, JWB 233, Salt Lake City, UT 84112, and **Ornella Mattei** and **Mihai Putinar**. *Untangling in time: designing time varying applied fields to reveal interior structure.*

In two phase materials, each phase having a non-local response in time, we were surprised to discover that for appropriate driving fields the response somehow untangles at specific times, allowing one to directly infer useful information about the geometry of the material, such as the volume fractions of the phases. This rests on the existence of approximate, measure independent, linear relations between the values that Markov functions take at a given set of possibly complex points, not belonging to the interval [-1,1] where the measure is supported. The problem is reduced to simply one of polynomial approximation of a given function on the interval [-1,1]. In the context of the motivating problem, the analysis also yields bounds on the response at any particular time for any driving field, and allows one to estimate the response at a given frequency using an appropriately designed driving field that effectively is turned on only for a fixed interval of time. The approximation extends directly to Markov-type functions with a positive semi-definite operator valued measure, and this has applications to determining the shape of an inclusion in a body from boundary flux measurements at a specific time, when the time-dependent boundary potentials are suitably tailored. (Received July 30, 2021)