1154-65-2104 **Alexander Zaitzeff** and **Selim Esedoglu*** (esedoglu@umich.edu), Department of Mathematics, 530 Church St., Ann Arbor, MI 48105, and **Krishna Garikipati**. *Variational extrapolation.*

Many problems in inverse problems and imaging have been addressed via variational models, requiring the minimization of a challenging cost function. Efficient optimization algorithms have been developed for many.

As is well known, once an efficient algorithm is found for the stationary problem of minimizing a cost function, the same algorithm can be used to generate an approximation to the dynamic problem of gradient flow, by solving a sequence of optimizations. This is a powerful approach to extending the know-how developed in imaging to applications where the dynamics, not just the finding of a stationary point, is important. The resulting scheme for the evolutionary problem is unconditionally stable, but is typically only first order accurate in time.

I will describe how a black-box optimization algorithm for a stationary problem can be used to generate high order accurate in time approximations to gradient flow, simply by calling the algorithm a few times per time step, while maintaining unconditional energy stability. The strategy is universal, making very few assumptions on the cost function. It can be seen as a variational analogue of Richardson extrapolation, the standard version of which lacks the stability guarantees of the new method. (Received September 17, 2019)