# MOVING FRAMES AND CONSERVATION LAWS: THE SE(2) AND SL(2) CASES

## POSTER ABSTRACT

M. ZADRA[1], E.L.MANSFIELD[2]

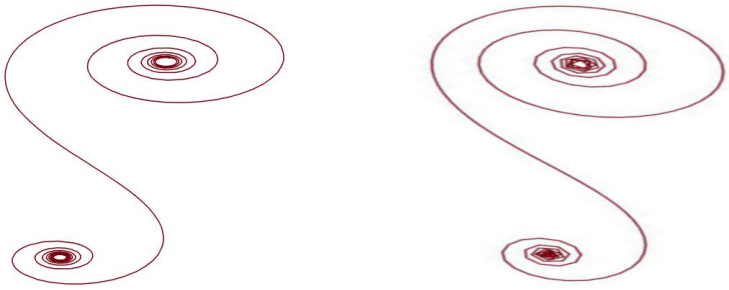
[1,2]UNIVERSITY OF KENT, SCHOOL OF MATHEMATICS, STATISTICS AND ACTUARIAL SCIENCES
CANTERBURY, KENT, ENGLAND, CT2 7NZ
[1]mz233@kent.ac.uk, [2]E.L.Mansfield@kent.ac.uk

In the study of variational problems, it is very useful to analyse the symmetries of a Lagrangian. We take a look at the case when these symmetries are given by SE(2) or SL(2).

A milestone in the study of variational systems is Noether's theorem, which allows us to derive the conservation laws. Our work takes place in the setting of the invariant calculus of variations, so our starting point is given by the conservation laws in the form derived in [1] and [2]. This involves the adjoint representation of the moving frame, a vector of invariants ($\mathbf{v}$) and a vector of constants ($\mathbf{c}$). The most general case is:

$$Ad(g)^{-1}_{|frame}\mathbf{v} = \mathbf{c}$$

If the constants and the vector of invariants are known, we show a method to derive the parameters appearing in the adjoint representation of the moving frame, and use it to find a solution to the variational problem. Regarding the outcome, we note that in some cases, the curve obtained as a solution is smoother than the one given by solving the system of differential equations in [1] and [2]. Applications are many and comprise animation, image recovering and wave motion.



Two examples for SE(2). A smoother solution (on the left) obtained with our method. On the right the solution obtained solving the system given in [1]

[1] T.M.N. Goncalves and E.L. Mansfield. "Moving frames and conservation laws for Euclidean invariant Lagrangians". In: Studies in Applied Mathematics 130 (2013).

[2] T.M.N. Goncalves and E.L. Mansfield. "On moving frames and Noether's conservation laws", in: Studies in Applied Mathematics 1 (2012).