

## Minimizing orbits in the parallelogram 4 body problem

Daniel C. Offin \*

[offind@mast.queensu.ca](mailto:offind@mast.queensu.ca)

URL : [www.mast.queensu.ca/~offind/](http://www.mast.queensu.ca/~offind/)

Abdalla Mansur      Mark Lewis

---

We consider the question of (in)-stability for the homographic family of rhombus solutions within the four degree of freedom parallelogram 4 body problem. Our approach to demonstrate instability for the entire parameter ranges of mass ratio and eccentricity, begins with a holonomically constrained system of rhombus configurations. This is a two degree of freedom problem and the homographic solutions we are studying belong to the constraint set. Minimizing the constrained action functional over a class of rhombus loops brings us again to the homographic family. We use this property of minimization to demonstrate the instability of the family in the unconstrained setting, after a series of reductions to remove degeneracies.

*This work is joint with Abdalla Mansur, and Mark Lewis.*

---

\*Department of Mathematics and Statistics, Queen's University, Jeffrey Hall, Kingston, ON K7L 3N6, CANADA.