# Shape Optimization Approach to the Bernoulli Problem: A Lagrangian Formulation

**Julius Fergy T. Rabago**[1] **and Jerico B. Bacani**[2]

Department of Mathematics and Computer Science
College of Science, University of the Philippines Baguio
Governor Pack Road, Baguio City 2600, Philippines
Email: [1]jfrabago@gmail.com, [2]jicderivative@yahoo.com

### Abstract

The exterior Bernoulli free boundary problem is reformulated into a shape optimization setting by tracking the Dirichlet data. The shape derivative of the corresponding cost functional is established through a Lagrangian formulation coupled with the velocity method. A numerical example using the traction method or $H^1$ gradient method is also provided.

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