

## MEED Seminar

March 15, 2019 – 13:00

Building Stevin, Room b.(-145) - MEED

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**A (multiple-)shooting approach aimed to study  
non-linear dynamics of bird flight**



## A (multiple-)shooting approach aimed to study non-linear dynamics of bird flight

Biomechanics behaviour which allows animal to achieve a flight, by responding to gust or environmental perturbations, is an object of interest, for the development of bio-inspired control schemes for flyers.

A lot of work has been carried out over the years for flapping wings dynamics, especially for insect-scale. However, the bird-scale counterpart is much more difficult to analyse, since the flapping frequency is similar to the natural frequency of the longitudinal mode for the flyer. Taking advantage of some approaches proposed in literature, we developed a shooting (and multiple-shooting) method, to detect the periodic orbit of a set of non-linear Ordinary Differential Equations (ODE), and based on that, the stability of the limit cycle will be assessed by the calculus of the eigenvalues of the Fundamental Matrix.

The numerical method has been validated with a test-function and the results will be shown. The conceptual model to analyse the bird flight dynamics, coupled with the lifting line model for evaluating time-varying forces, is proposed and discussed.