# Unwanted Rotorcraft-Pilot Couplings
## Aeroelastic and Biodynamic Implications of Human-Machine Interaction

**Background** Rotorcraft-Pilot Couplings (RPCs) are adverse, unwanted interactions of the pilot with the vehicle (for example a helicopter or a tiltrotor), a type of phenomena that result when **the motion of the vehicle causes the pilot to involuntarily act on the control inceptors**. RPC events can degrade the handling qualities of the vehicle, prevent the completion of a task or even result in catastrophic events.

**Motivation** At FRAME Sim, the flight simulation laboratory of FRAME Lab, a project has been launched to study RPCs and means for their prevention, addressing topics as diverse as the **aeromechanics** of rotorcraft, the **biomechanics** of pilots, and the **ergonomic characteristics** of the cockpit. The final objective is to **gain adequate confidence** in the capability to **predict** RPCs and the **susceptibility** to RPC of novel cockpit and control inceptor layouts.

**Methodology** A **motion base**, similar to a full-motion flight simulator, will be developed and equipped with highly reconfigurable control incoptors. It shall be able to reproduce a broad variety of rotocraft cockpit configurations, and even to explore possible solutions for innovative Urban Air Mobility vehicles. It shall have dynamical characteristics suitable for reproducing RPC events. It will be initially used as a means to investigate the **transmissibility** of cockpit accelerations to the control inceptors through the human body, to improve the capability to model and estimate the biomechanical characteristics of rotorcraft pilots. Existing **numerical models** of rotorcraft aeromechanics and pilot biomechanics will be updated, and new ones will be developed, based on the results of the experiments, mostly conducted with the participation of trained pilots, including rotorcraft test pilots. The project is supported by a **major European rotorcraft manufacturer**.

**PhD opportunities** 1 position closing March 2020, with enrolment May 1st, 2020
1 (possible) position closing May 2020, with enrolment November 1st, 2020

**Educational objectives** A blend of aeronautics, biomechanics, system identification, ergonomy, and simulation. The candidate will be exposed to and will have to proactively work in all of the above areas, supported by experts in each of the fields.
Ideal candidates shall have competences in **rotorcraft aeromechanics**, **biomechanics**, **signal processing**, and attitude towards experimental activity.

**Job opportunities** The candidate(s) will gain considerable experience in the **management of complex problems** related to aeronautics and man-machine interaction, a blend of competences that is highly requested not only by the aerospace, but also by the transportation industry at large. As already mentioned, the work is in strict cooperation with a major European rotorcraft manufacturer.

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