



## Evaluation of IMU Orientation and Angle Computation Algorithms Using a Gimbal Apparatus

Inertial measurement units (IMUs) have proven to be useful devices for mobile motion analysis. For the precise computation of kinematic parameters (angles, trajectories), validated algorithms are required. Usually, IMU based parameters (for example in a gait or running study) are compared against gold standard methods like motion capture systems. However, these systems are often expensive and not always available.

For the pure evaluation of computed parameters, a gold standard measurement system could be avoided if the exact trajectory of the IMU during the movement is known. In this context, a gimbal apparatus which is able to hold an IMU in its center can serve as a valuable tool, as it allows to bring the IMU into defined orientations and also to run any predefined rotation sequences. A gimbal apparatus in combination with an IMU that streams data in real-time can also be used for demonstration purposes if visualization is provided: An animated sensor, plots from respective sensor axes and numerical values should be shown in real time.

From a technical and scientific standpoint, the tool should be usable for the development, comparison and validation of algorithms that allow the computation of IMU orientation and rotation angles.

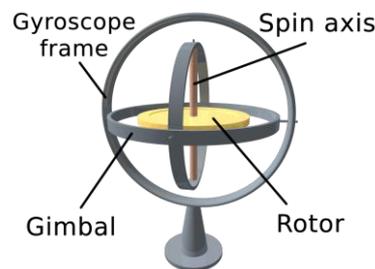


Figure 1: Example of a gimbal apparatus (<https://en.wikipedia.org/wiki/Gyroscope>)

### What you will do:

- Literature research: IMU orientation and rotation computation approaches
- Hardware development: Design, selection of materials, manufacturing, testing
- Implementation of different orientation / rotation algorithms
- Testing and evaluation of different algorithms in an experimental study: design of a study protocol, testing under different conditions
- Real time visualization of raw data and analysis results (animated sensor)

### Requirements:

- Experience with hardware design and craftsmanship skills
- Basics in pattern recognition and signal analysis (Matlab/Python)
- Interest in wearable computing and sensor technologies
- Working in an interdisciplinary field and solving state of the art problems
- Creativity and ability to work independently

For further information or if you are interested please contact us.

Start date: now, flexible

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