Passive rider identification

In bicycles the rider's mass is much larger than the vehicle's mass. Hence, the rider influences the dynamic behaviour of the bicycle not only by means of voluntary control actions, but also by means of passive response of his/her body to bicycle oscillations. As a matter of fact, the rider's body has inertial, stiffness and damping properties that are combined with the bicycle characteristics and affect the dynamic response of the whole system. More specific, the stabilization of dangerous oscillatory two-wheeler modes such as weave and wobble can be significantly influenced by the rider's properties. For these reason, it is prerequisite to identify the passive response of the rider's body to study the dynamic behaviour of the combined bicycle-rider system.

To measure the rider response an instrumented bicycle mock up fitted with strain gauges at all interfaces has been developed. The frame was designed to recreate the geometry of a hybrid bicycle and has a reach to handlebars equal to 32 cm and a stack height to handlebars equal to 75cm. The bicycle mock-up was mounted on a top of a hexapod and was excited using coloured noise perturbations in all 6 degrees of freedom (DoF). The force response of the rider body was measured at all bicycle interfaces. Two IMU's were also used to measure the transmissibility of the upper rider trunk. One IMU was placed on the base of the platform and one at the rider's sternum.

The repository contains the following folders and files:

- **Bicycle_mock_up _figures:** pictures of the mock-up.
- **CAD :** contains the solidworks drawings of the bicycle mock up.
- **Force_data :** contains the rider's force responses at all bicycle interfaces.
- **IMU_data** and **IMU_data_Upper trunk** includes the measured translational accelerations and angular velocities of the platform and rider's upper trunk.
- **Labview :** contains the software used for data logging the strain-gauge signals.
- **Paper_figures:** contains all pictures of the corresponding paper.
- **Strain_gauges:** includes the crosstalk and voltage to forces formulas and force sign conventions for all bicycle interfaces respectively.
- **Subjective_data:** contains the NASA TLX data, mat.script.

SupplementaL_paper_material contains:

- **Assymetric_elements.xlsx** contains the symmetric and asymmetric elements of the dynamic force distribution.
- **Correlation.jpg** shows the correlation between the performance and effort scale of NASA "Raw-TLX".
- **Schematic_1.jpg** represents the trunk-pelvis system of the rider as a horizontal moving inverted pendulum, see discussion section of paper.
- **STST_individuals.jpg** represents the seat-to-sternum measurements for all motions. The grey lines indicate the responses of the 1st data cluster (16 subjects) whereas the coloured lines the responses of the 2nd data cluster (8 subjects).