aim arnold intelligente messsysteme

Dynamic Measuring Wheel for Two-Wheelers

ROLSmc-HD

Overview

The measuring wheel system **ROLSmc-HD** has been designed to carry out vehicle dynamics tests as well as acquiring operating loads. It was developed especially for the conditions required by two-wheelers. For instance low power consumption as well as restricted space requirements were taken into account. **ROLSmc-HD** additionally has a significant reduced rotating mass to avoid influences to the vehicle specific dynamics.
With a supply voltage of $12V$, the current consumption is only $0.4A$. Besides the cable connecting to the vehicle battery and the data recorder **ROLSmc-HD** does not require any additional external components. All control functions (angular offset, configuration, etc.) as well as the data output are conducted via the CAN interface.

Design and Function

The wheel loads are detected in a circular measuring element, consisting of five strain gauge based 3-component measuring elements. The complete force flow is introduced through the tire to the one-piece CFC-rim. Located in the center of the CFC-rim the sensor unit is mounted. All electronic components are placed in a co-rotating housing, which is located in the wheel hub. The power supply and the data transfer takes place through a connector on the non rotating side.

The 15 bridge signals from the strain gauge measuring elements are amplified and digitally processed by the co-rotating electronics with an integrated powerful DSP. In this procedure wheel forces and wheel moments are calculated by means of calibration information and wheel geometry in physical units. The transformation into the non-rotating coordinate system is executed by using the angle of rotation determined via the signal from the integrated optical encoder. Output of the data with $16/24/32bit$ resolution takes place via a CAN (FD) interface. An additional line which can be operated in master or slave mode provides synchronization with further systems.

Sensor ROLSmc-HD (standard values)

Measuring channel	Measuring range	Linearity error	Crosstalk*
Fx	16 kN	$< 1\%$	$< 1\%$
Fy	3 kN	$< 1\%$	$< 1\%$
Fz	16 kN	$< 1\%$	$< 1\%$
Mx	900 Nm	$< 2\%$	$< 1\%$
My	3000 Nm	$< 1\%$	$< 1\%$
Mz	900 Nm	$< 2\%$	$< 1\%$
Angle encoder	360° / 96.000 steps	$< 0.1\%$	–
Temperature drift	–	$< 0.02\%$ FS/°C	–
* The calculation of the values takes place by the signals, normalized by FS of each channel.			

Measurement/Electronics ROLSmc-HD

Type	Unit	Value
A/D Converter	Bit	SAR 16
Samping rate	MHz	1, synchronous
Output format	-	CAN (FD) 16/24/32bit, more on request
Output rate	Hz	250...8000
Output channels	-	Fx, Fy, Fz, Mx, My, Mz, Ang, Asp
Signal processing	-	DSP Control of sampling, digital filtering, calibration of input channels, calculation of wheel forces, coordinate transformation, output formatting, control of all functions via CAN
Supply voltage	V	10...18
Current consumption at 12V	A	≈ 0.4
Temperature range	°C	$-20...80$
Weight front wheel*	kg	$< 9,5$
* Exemplary 17"x3,5"front wheel with break discs and tire.		

Comparison ROLS*mc* vs. ROLS*mc*-HD

	ROLS*mc*	ROLS*mc*-HD	Reduction by
		Wheel mass	
Front wheel 3,5x17”	$4.92kg$	$3kg$	$\approx 40\%$
Rear wheel 6x17”	$6.85kg$	$3.31kg$	$\approx 52\%$
		Moment of inertia I_{yy} (about wheel axis)	
Front wheel 3,5x17”	$0.165kgm^2$	$0.0912kgm^2$	$\approx 45\%$
Rear wheel 6x17”	$0.215kgm^2$	$0.1021kgm^2$	$\approx 53\%$
*** Comparable geometry without tires, brake discs and wheel electronics. ***			

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