Performance of Bicycle Tyres – Effect of vertical load and inflation pressure

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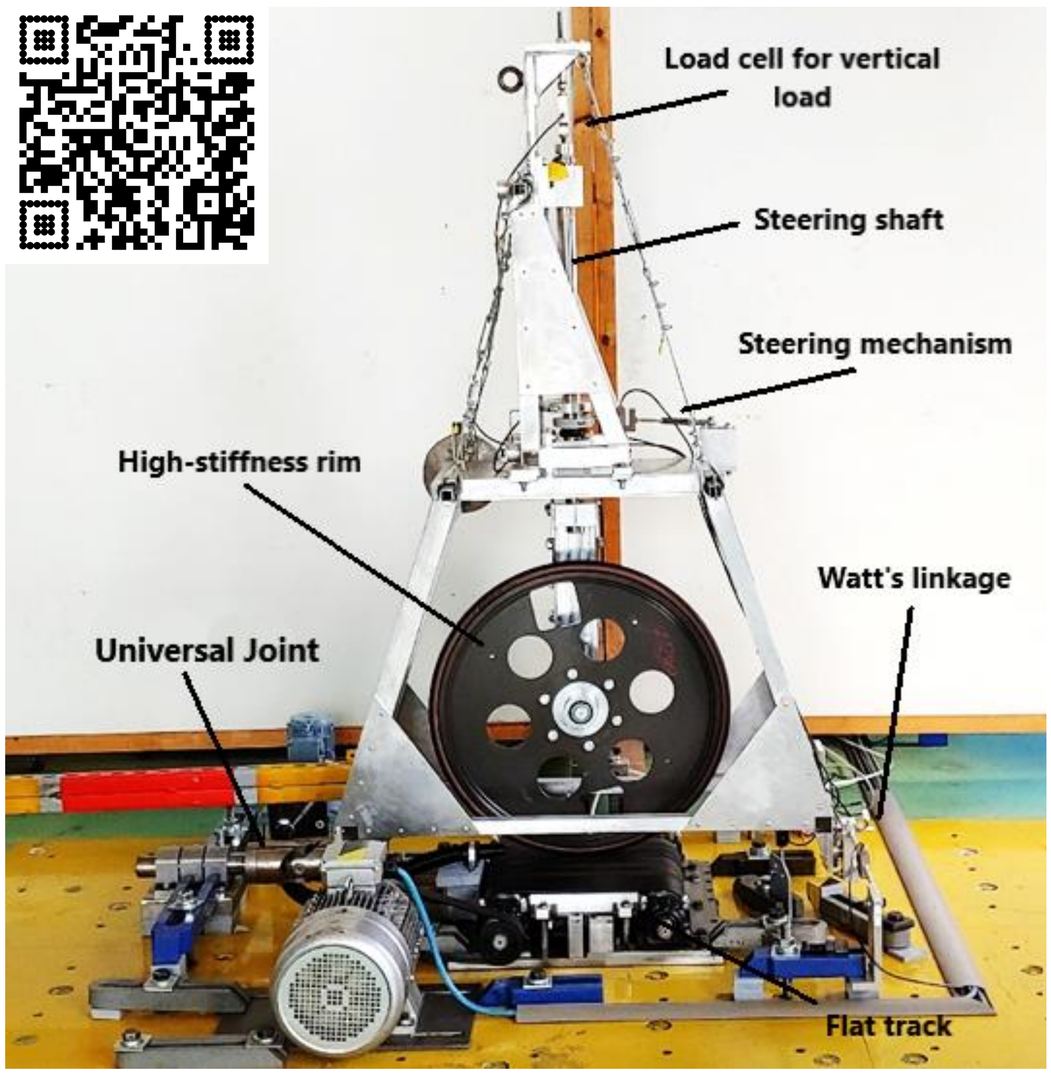

Figure 1 VeTyT test-rig with high-stiffness rim mounted on. The main subsystems are enlightened.

Objectives and Methods

Tyres affect bicycle dynamics [1]

Overall bicycle performance

A new **test-rig** for bicycle tyres (**VeTyT** → **Ve**lo **Ty**re **T**esting) to measure tyre mechanical characteristics [2,3].

Focus on lateral characteristics (Lateral force, self-aligning moment)

Tests on flat track

Effect of different working parameters, for 26 mm wide road racing tyre: inflation pressure (3,5 – 10,5 bar), vertical load (260 – 640 N)

Results

The combined effect of vertical load and inflation pressure variation has been studied for a 26 mm wide road racing bicycle tyre. For low vertical loads, cornering stiffness is higher for less inflated tires. Conversely, by increasing the vertical load, the tires must be inflated more to generate higher cornering stiffness [4].

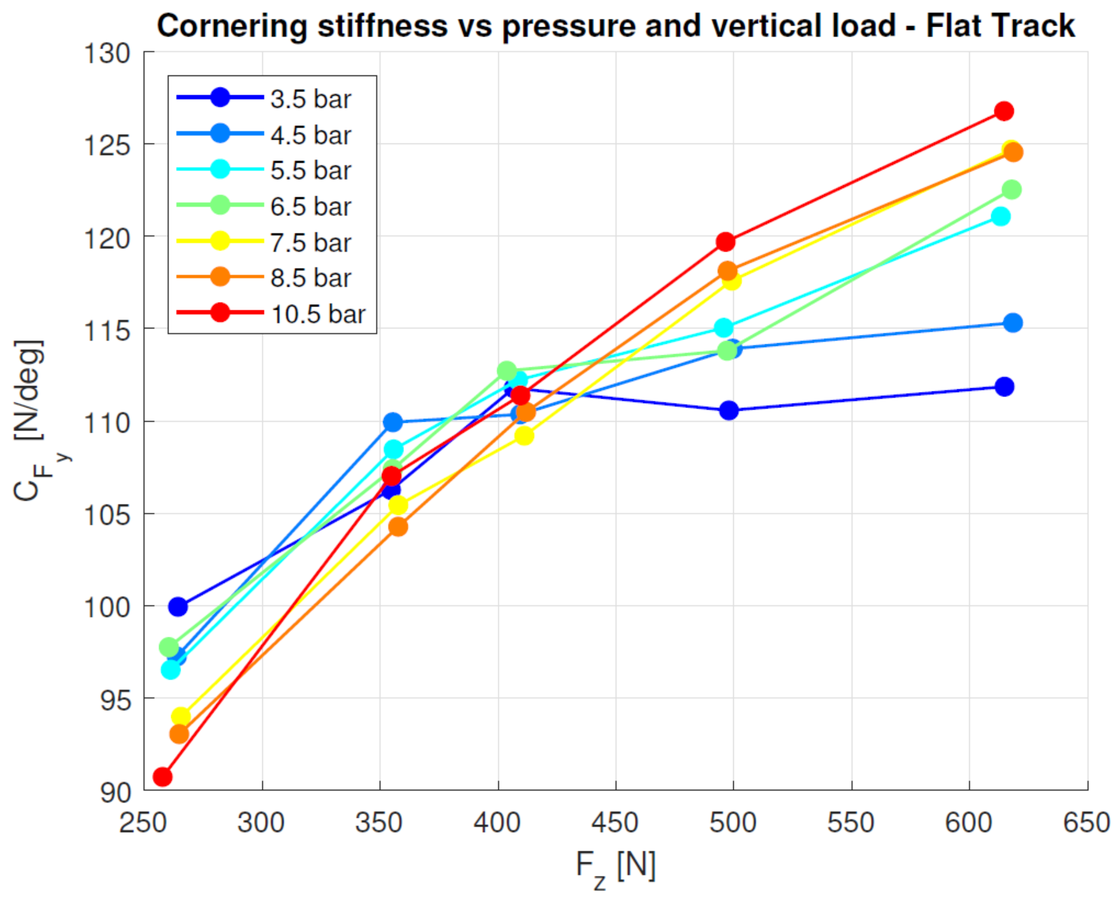

Figure 2 Cornering stiffness as function of vertical load. Lines with different colors refer to different inflation pressure.

Take home message

Marginal gains in curves/downhills from tyre lateral characteristics

Inflation pressure should be adjusted according to **vertical load**

References:

[1] Bulsink, V.E., Doria, A., Van De Belt, D., Koopman, B. (2015) "The effect of tyre and rider properties on the stability of a bicycle," Adv. Mech. Eng., vol. 7, no. 12, Dec. 2015

[2] Dell'Orto, G., Ballo, F. M., Mastinu, G. (2022) "Experimental methods to measure the lateral characteristics of bicycle tyres – a review," Vehicle System Dynamics

[3] Dell'Orto, G., Ballo, F. M., Mastinu, G., and Gobbi, M. (2022) "Bicycle tyres – Development of a new test-rig to measure mechanical characteristics" Measurement, vol. 202, p. 111813

[4] Dell'Orto, G., Ballo, F. M., Mastinu, G., Gobbi, M., Magnani, G. (2023) "Racing bicycle tyres – Influence on mechanical characteristics of internal pressure, vertical force, speed and temperature," European Journal of Mechanics / A Solids, vol 100