MECHANISMS FOR THE REAR AXLE STEERING BOX WITH INTEGRAL STEERING

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Abstract: This paper addresses the problem of integral steering that has the rear wheels steering in the same direction to the front wheels, but also in the opposite direction. Simple articulated mechanisms for the rear axle steering box are presented, mechanisms that steer the rear wheels according to the direction of the front wheels, respectively to the rotation angle of the steering wheel. At the begging of a turn, the considered/proposed mechanisms are steering the rear wheels in the same direction to the front wheels, then brings them back to neutral to steer them in the opposite direction. The functionality of the system is analyzed – the extent to which the requirements of the integral steering are met by the considered/proposed mechanisms.

1. INTEGRAL DIRECTION ISSUE

Steering of vehicles with two steering axles can be accomplish by reducing the steering radius (fig.1,b) or increase it (fig.1,c), as the rear wheels are steered in the opposite/same direction to the front ones.

$$r_{v_1} = \frac{L_a}{tg\,\theta_f}, \qquad r_{v_2} = \frac{r_{v_1}}{1 + tg\,\theta_s / tg\,\theta_f}, \qquad r_{v_3} = \frac{r_{v_1}}{1 - tg\,\theta_s / tg\,\theta_f}. \qquad (1)$$

The notations from figure and relations are referring to:

L_a - axle base, distance between vehicle axels,

B_p - distance between steering wheels pivots,

O_v - the turning center, normal intersection at the wheels trajectory,

r_v - steering radius - distance from O_v at the vehicle axis;

$\theta_{f,s}$ - the front/rear wheel steering angle.

As the steering radii are:

$$r_{v_2} = \frac{L_a}{tg\,\theta_f + tg\,\theta_s}, \qquad r_{v_3} = \frac{L_a}{tg\,\theta_f - tg\,\theta_s}, \qquad (2)$$

aratio $k = \theta_f / \theta_s$ could be maximum $k = 1$for steering in opposite direction, respectively maximum $k = 0.5$for steering in the same direction.

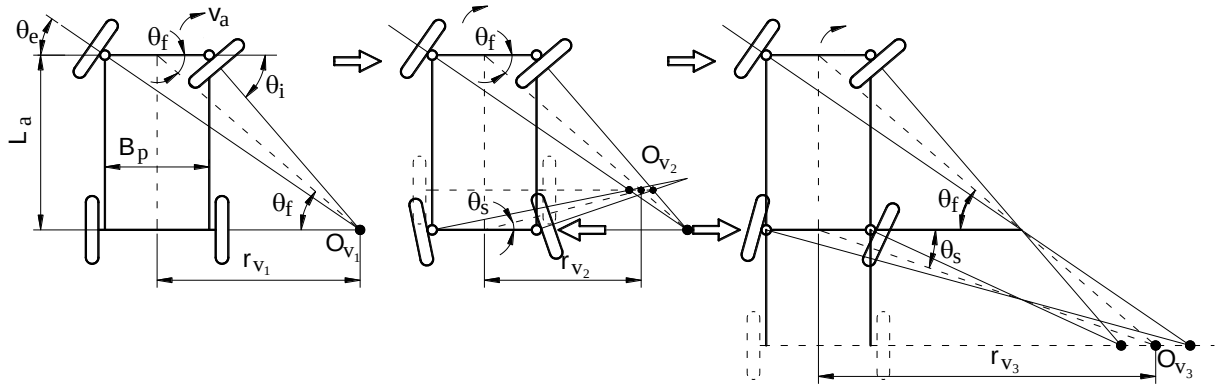

Figure 1. The turning radius and the steering angles for 1/2 steering axle.