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Development of an algorithm for searching the optimal trajectory of the object in the conditions of given restrictions

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Purpose of research

- develop a control method of mobile robot;
- conduct an experiment of the developed method.

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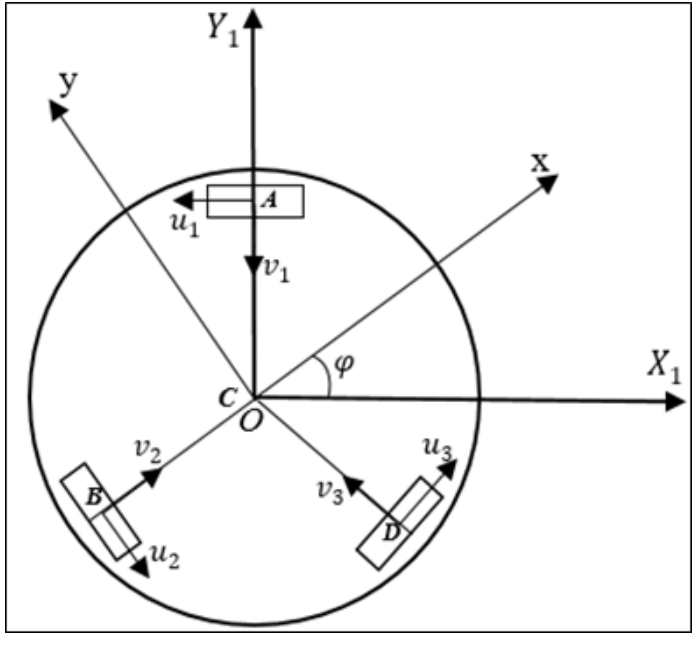
Mobile robot

- autonomous control system;
- three DC motors;
- move in all directions;



Mathematical model of the mobile robot

- $OX_1Y_1Z_1$ - fixed coordinate axes;
- $CXYZ$ - axes associated with the robot platform;
- A_{u1v1w1}, B_{u2v2w2}, D_{u3v3w3} - axes systems associated with wheels;
- φ - angle between the fixed axis OX_1 and the local axis of the robot C_x

$$
\begin{cases}
\dot{X}_C = V_{CX_1}, \\
\dot{Y}_C = V_{CY_1}, \\
\dot{\varphi} = \Omega, \\
V_{Cx} = V_{CX_1}\cos\varphi + V_{CY_1}\sin\varphi, \\
V_{Cy} = -V_{CX_1}\sin\varphi + V_{CY_1}\cos\varphi, \\
\Omega_A = \dfrac{1}{r}\left(-V_{Cx}\cos 30^\circ + V_{Cy}\sin 30^\circ + l\Omega\right), \\
\Omega_B = \dfrac{1}{r}(-V_{Cy} + l\Omega), \\
\Omega_C = \dfrac{1}{r}\left(V_{Cx}\cos 30^\circ + V_{Cy}\sin 30^\circ + l\Omega\right)
\end{cases}
$$

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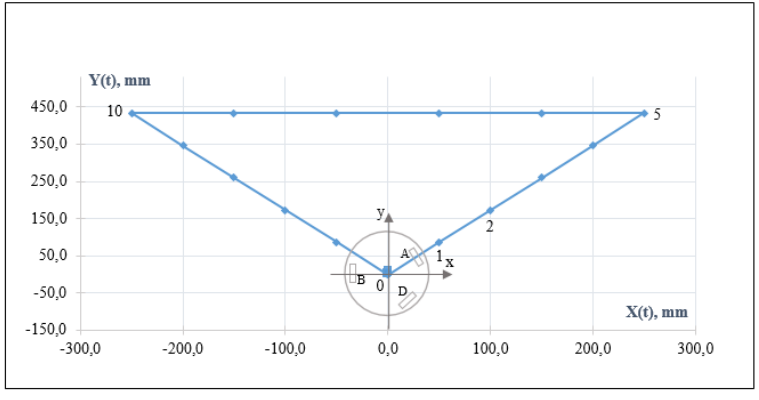
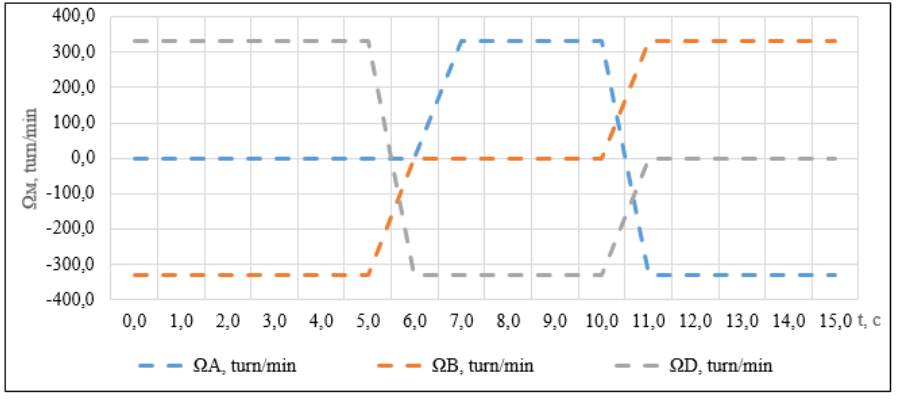
Trajectory of the robot





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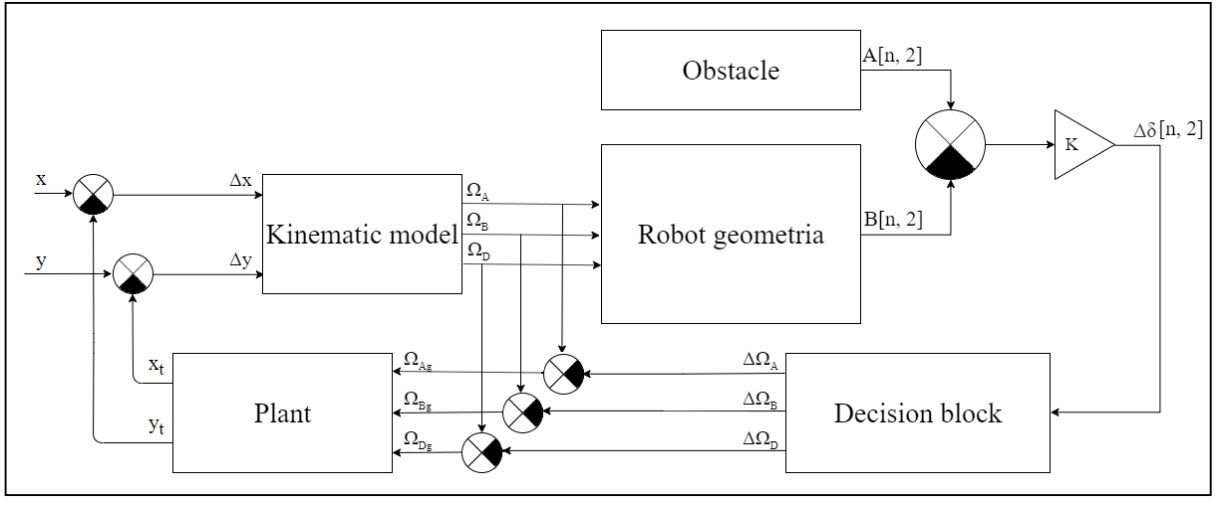
The block diagram of the algorithm



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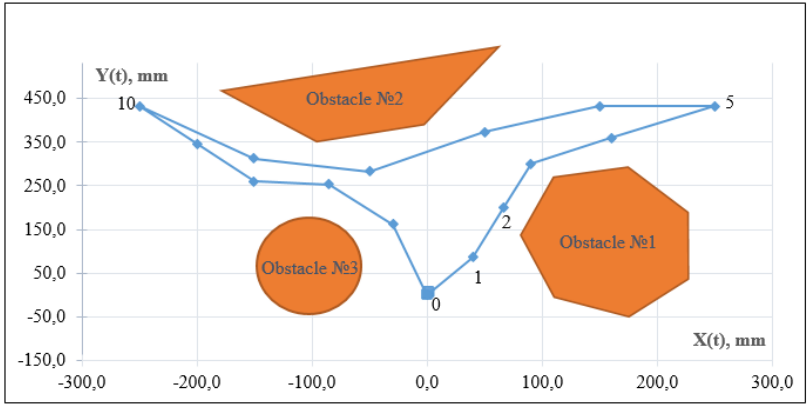
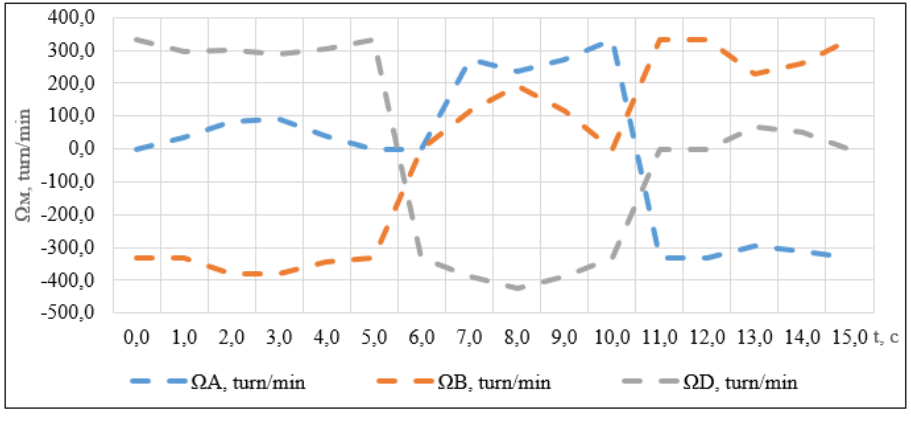
Robot trajectory with obstacles





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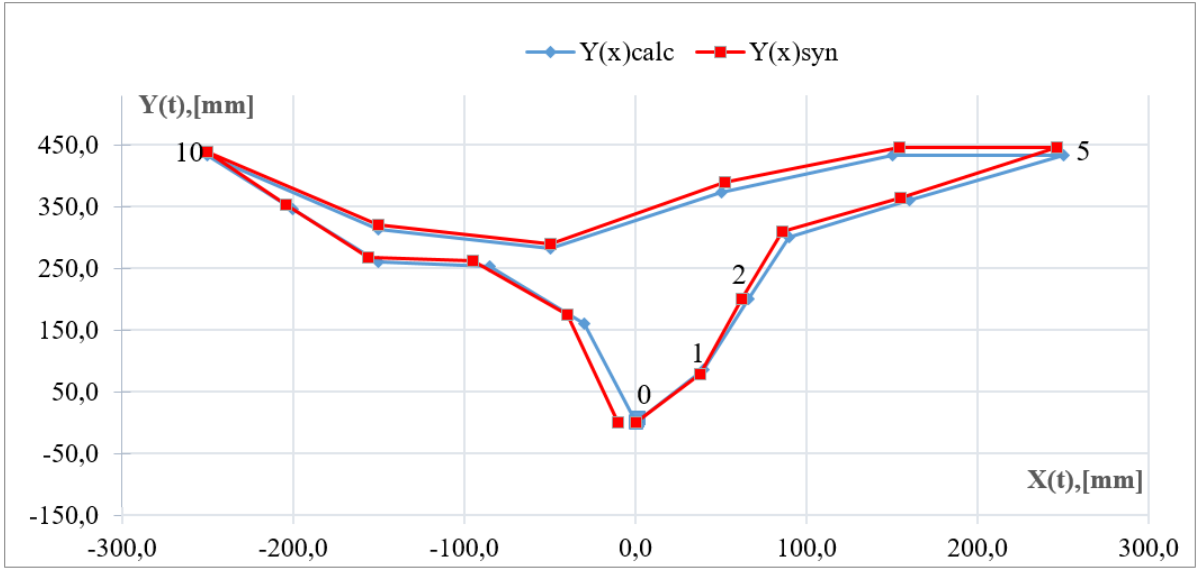
Calculated and synthetic robot paths



Error of parameter values

Error	Value	Unit
Absolute error		
X coordinate	4,45	mm
Y coordinate	10,68	mm
Relative error		
X coordinate	0,03	%
Y coordinate	0,04	%

Conclusion

- mathematical model was developed;
- method of avoiding obstacles was developed;
- comparative analysis of the calculated and synthetic motion of the robot.

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Thank you for attention!

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