

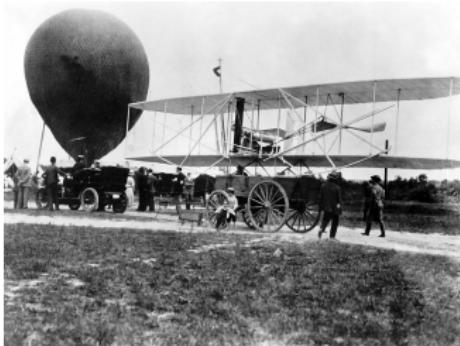
Algebra, Geometry and Robots

The two-way relationship between mathematics and robotics, with a focus on modern algebra and geometry.

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University of Sydney

The Story of Humanity



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ChatGPT



What day of the week is it?

Today is Thursday.



Humanity's Next Tool: Robots



KUKA - Robotic Arms



Waymo -
Self-Driving Cars



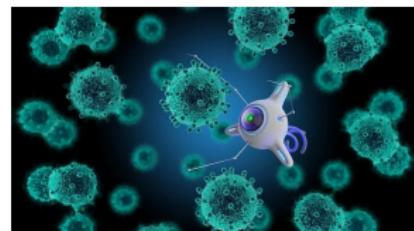
NASA - Martian Rovers



BMW -
Humanoid Robots



Boston Dynamics -
Dog Robots



Nanorobots

What is Robotics?

Common Definition of Robotics

$R(t)$ = Robotics at time t

$A(t)$:= What's Theoretically Possible at time t

$P(t)$:= What's Already Possible at time t

$$R(t) := A(t) - P(t)$$

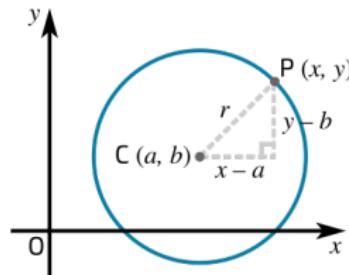
Goal of Robotics

$$\lim_{t \rightarrow \infty} R(t) = 0$$

The Story of Mathematics

$$1 + 2 = 3$$

$$ax^2 + bx + c = 0$$



$$\begin{pmatrix} a_{11} & a_{12} & a_{13} \\ a_{21} & a_{22} & a_{23} \\ a_{31} & a_{32} & a_{33} \end{pmatrix}$$

$$\mathrm{GL}_n(\mathbb{R})$$

 $\mathrm{Grp} \rightarrow \mathrm{Set}$

The Story of Mathematics: Today's Mathematics

Algebra

Analysis

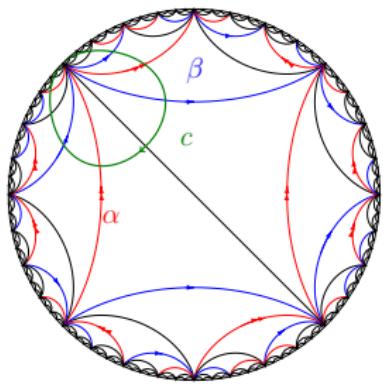
Topology

Geometry

Overview

- 1 Humanity
- 2 Mathematics
- 3 Who am I?
- 4 Kempe's Universality Theorem
- 5 Gröbner Basis
- 6 Lie Theory
- 7 Other Applications

Who am I?



Recent Master's in
Mathematics (Geometric
Topology)



Started PhD with ACFR and
CSIRO's Robotic Perception
and Autonomy Group

Kempe's Universality Theorem

Gröbner Basis

Lie Theory

Other Applications of Mathematics