دانشکده مهندسی برق
گروه کنترل و سیستم
نیم‌سال دوم ۱۳۹۹-۱۴۰۰

به نام آنکه جان را فکرت آموخت

# رباتیک

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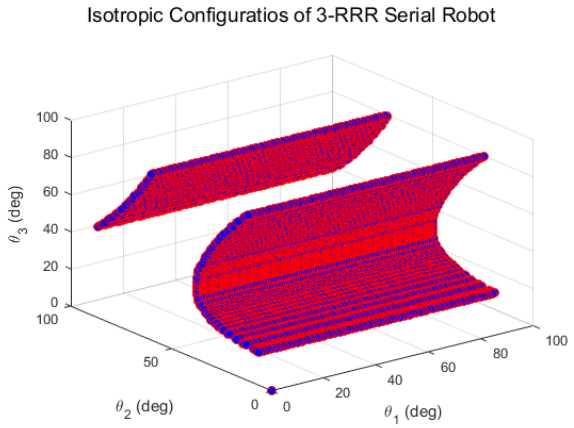
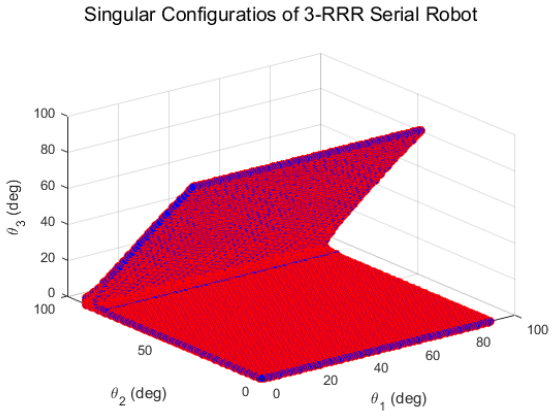
۱۳۰۷
دانشگاه صنعتی خواجه نصیرالدین طوسی
استاد: حمیدرضا تقی راد

**Investigate the MATLAB codes first, then read this report.**

**Case Study1:**




$$\det(J_v) = 0 \rightarrow L_2L_3\big(cos(\theta_2+\theta_3)sin(\theta_2) - sin(\theta_2+\theta_3)cos(\theta_2)\big)\big(L_3cos(\theta_2+\theta_3) + L_2cos(\theta_2)\big) = 0$$

$$\det(J_v) = 0 \rightarrow -L_2L_3(\sin(\theta_3))\big(L_3cos(\theta_2+\theta_3) + L_2cos(\theta_2)\big) = 0$$

1. $\sin(\theta_3) = 0 \rightarrow \theta_3 = 0$
2. $L_3cos(\theta_2+\theta_3) + L_2cos(\theta_2)$

**Case Study 2.**

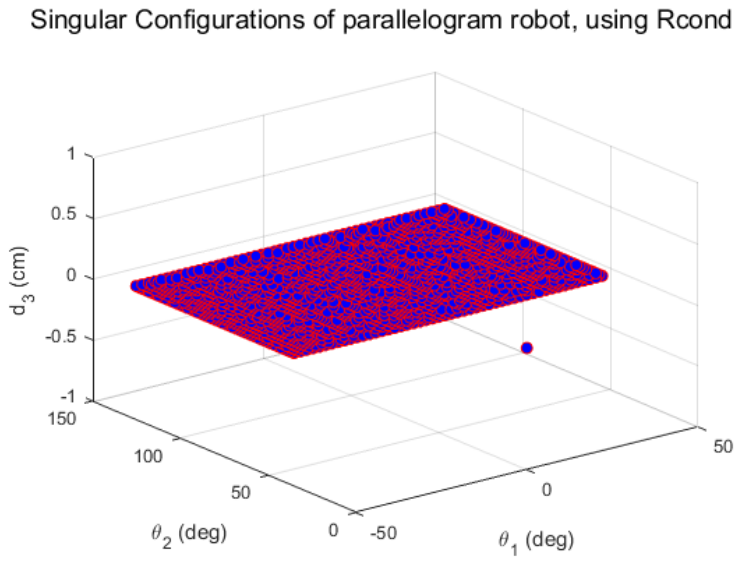
1. $det(J_v) = 0 \rightarrow L_1L_5(-\sin(-\theta_3+\theta_2))\big(-L_5\cos(\theta_2) + L_1(\theta_3)\big) = 0$

$-\sin(-\theta_3+\theta_2) = 0$

$-L_5\cos(\theta_2) + L_1(\theta_3) = 0$

2. Optimal Solution GA = 0.88 , Optimal Solution Fmincon = 0.88.

**Project:**




$\det(J_v) = 0 \rightarrow -\sin(\theta_2)\, d_3^2 = 0$

$\theta_2 = 0$ is not within the range of mechanical workspace.

$d_3 = 0 \;\; \rightarrow RCM\ Singularity$

The use of a structure with a remote fixed point around which a mechanism can rotate is called remote centre of motion (RCM). The technique is widely used in minimally invasive surgery to avoid excess force on the incision site during the robot's motion.