



## Industrial Consultancy & Sponsored Research (IC&SR)

### DESIGN OF A 6 DOF MASTER MANIPULATOR ARM WITH ENHANCED GRAVITY COMPENSATION AND COMPLIANT GRASPING FOR ROBOTIC SURGERY

**IITM Technology Available for Licensing**

#### PROBLEM STATEMENT

- In the Robotics surgeries, **master arms** used as input devices which help to **capture the hand movement** of an **operator** in space.
- In the prior design, there was at least **2 DOF** which can move in a plane with an additional out of plane DOF.
- Said prior art design **suffers** from **increased inertia** including other associated issues.
- Further Parallel linkage based design overcomes some of the balancing problems but **has limited workspace** compared to a serial linkage based design.

#### TECHNOLOGY CATEGORY/MARKET

**Technology:** 6 DOF Master arm of a tele-operated robotic system;

**Industry:** Medical Surgical Instruments;

**Application:** Orthopedics, Urology, Gynecology, Neurology, other;

**Market:** The global **surgical robot** market is projected to grow **\$12.73B** by **2027** at a **CAGR** of **17.5%** during the period (**2022 -2027**);

#### TECHNOLOGY

- Present invention describes the design of a **master arm** which serves as an input device for a **tele-operated robotic system**.
- The master arm has **6 DOF(Degrees of Freedom)** with **strategically distributed mass** which inherently **provides partial self-balance** and requires minimal number of counter masses for gravity compensation.
- The proposed design includes a **wrist decoupled design**

#### KEY FEATURES / VALUE PROPOSITION

**Technical Perspective:** The master arm design requires **minimal number of counter masses** for **gravity compensation**.

1.Proposed design offers **reduced complexity, weight**

& **backlash free operation** with **reduced joint friction**.

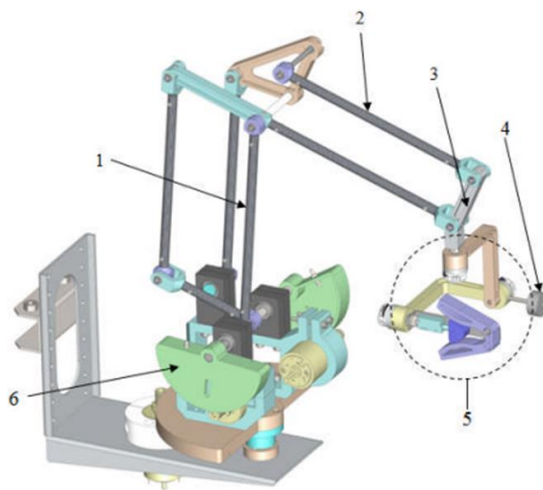
2.Said design uses a compliant mechanism –based grasper that uses **flexures**, & further uses a **circular profile** with a **follower** operates in **linear motion**.

3.Said mechanism is **immune to backlash**, **lubrication free** and **does not generate wear debris**.

#### Industrial Perspective:

1. Advantages both for **serial & parallel linkages** with **minimum no. of balance masses**.

#### IMAGES



**Figure.1:** Illustrates the master arm assembly

#### INTELLECTUAL PROPERTY

**IITM IDF Ref.: 1332;**  
**IN Patent No. 424737 (Granted)**

#### TRL (TECHNOLOGY READINESS LEVEL)

**TRL- 3, Proof of Concept Ready Stage**

#### RESEARCH LAB

**Prof. Asokan T**  
Dept. of Engineering Design

#### CONTACT US

**Dr. Dara Ajay**, Head  
Technology Transfer Office,  
IPM Cell- IC&SR, IIT Madras

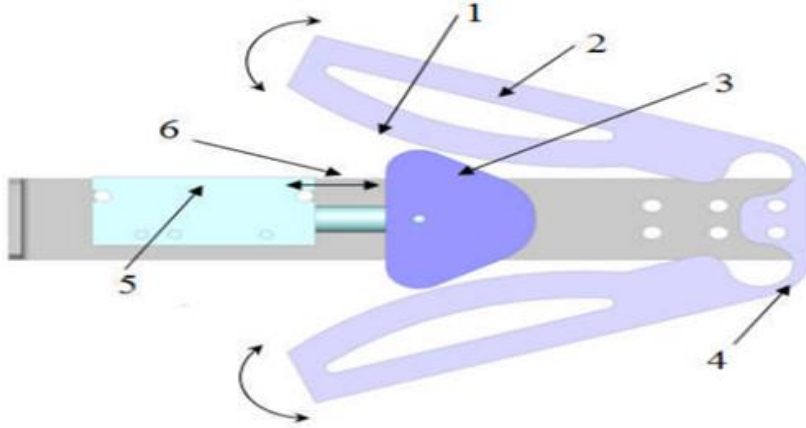
**IITM TTO Website:**  
<https://ipm.icsr.in/ipm/>

**Email:** [smipm-icsr@icsrpis.iitm.ac.in](mailto:smipm-icsr@icsrpis.iitm.ac.in)

[sm-marketing@imail.iitm.ac.in](mailto:sm-marketing@imail.iitm.ac.in)

**Phone:** +91-44-2257 9756/ 9719

IMAGES



**Figure 2: Illustrates the compliant grasper design**

**CONTACT US**

**Dr. Dara Ajay**, Head  
Technology Transfer Office,  
IPM Cell- IC&SR, IIT Madras

**IITM TTO Website:**  
<https://ipm.icsr.in/ipm/>

**Email:** [smipm-icsr@icsrpis.iitm.ac.in](mailto:smipm-icsr@icsrpis.iitm.ac.in)

[sm-marketing@imail.iitm.ac.in](mailto:sm-marketing@imail.iitm.ac.in)

**Phone:** +91-44-2257 9756/ 9719