

# Real-time Detection of Position and Orientation of Wireless Endoscopy Capsule using Magnetic Coupling

## Summary

Vanderbilt researchers have developed a new method to detect the position, orientation, and pressure exerted on surrounding tissues of a wireless capsule endoscopy device. Magnetic coupling is one of the few physical phenomena capable of transmitting actuation forces across a physical barrier. Magnetic manipulation has the potential to make surgery less invasive, by allowing untethered miniature devices to enter the body through natural orifices or tiny incisions, and then maneuver with minimal disruption to healthy tissue. In order to accomplish this goal, the pose (position and orientation) of the medical device must be available in real time. The method detailed here aims to accomplish this task.

## Addressed Need

- Endoscopy in GI tract requires sedation and is difficult to maneuver
- Wireless capsule endoscope cannot be remotely manipulated with open loop control (no feedback)
- External magnetic field used for magnetic locomotion prevents current solutions from identifying position and orientation of capsule inside the body

## Technology Description

Magnetic capsules are usually coupled with an external source of magnetic field that controls their position and orientation. A set of sensors

(e.g. magnetometer, inertial sensor, etc.) are placed inside the capsule. The information detected by these sensors is wirelessly transmitted to an external system in real-time. This external system determines the absolute position of the capsule along with the magnetic and inertial forces acting on it. Given force and capsule dimension, the pressure on the capsule is determined.

## Advantages

- Provides 6 degrees of freedom in real-time
- Designed for wireless operation
- Allows for closed-loop control
- Exhibits low error in position and orientation detection
- Compatible with magnetic locomotion

## Potential Applications

- Controlled wireless capsule endoscopy
- Controlled drug delivery
- Surgical capsules operating in the gastrointestinal tract

## Intellectual Property Status

- Pending US Application [US20150342501 A1](#)
- Peer reviewed publication: C. Di Natali, M. Beccani, P. Valdastrì, "Real-Time Pose Detection for Magnetic Medical Devices", *IEEE Transactions on Magnetics*, 2013, Vol. 49, N. 7, pp. 3524-3527
- Tech Video: [https://youtu.be/fj\\_GpNim\\_Jw](https://youtu.be/fj_GpNim_Jw)

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