

Postgraduate student: **Karampoulas Konstantinos**

Thesis title:

## **Operation principles of laparoscopic imaging systems**

### Abstract

The object of this study is to evaluate, through a theoretical model, the physical properties of laparoscopic visualization. The imaging device of laparoscopy will be analyzed into individual stages. The theory of linear systems, describing the transfer of signal and noise through the implementation of stochastic processes will be implemented on the stages and the final signal and noise properties will be evaluated. The result of the theoretical model is an equation that provides the detective quantum efficiency (DQE) of laparoscopic imaging. For each stage, the variation of DQE for various parameters will be studied.

At first the theoretical model will be described. The implementation of the equations used for calculating the parameters of the theoretical model will be done using the programming language matlab, for each involved stage.

Specifically, the basic procedures are examined in the system are: amplification, spreading and blurring. The model consists of a total of ten stages. Each stage have an equation that describes a process where the output of one stage is the input of the next. For each stage, depending the procedure, calculate the measures of NPS (Noise Power Spectrum), transfer function MTF and mean value of photons/electrons. The result is an equation that provides the detective quantum efficiency (DQE) of laparoscopic imaging.

**SUBJECT AREA:** Laparoscopy, Image Quality Measures

**KEYWORDS:** laparoscopic surgery, laparoscopic imaging, optical fiber, charge-coupled devices, detective quantum efficiency, noise power spectrum, DQE

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