1. Record Nr. TD20018664

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Titolo	Nonlinear effects in finite elements analysis of colorectal surgical clamping [Tesi di dottorato]
Lingua di pubblicazione	Inglese
Formato	Tesi di dottorato
Livello bibliografico	Monografia
Note	diritti: info:eu-repo/semantics/openAccess In relazione con info:eu-repo/semantics/altIdentifier/hdl/11573/1242194
Sommario	Minimal Invasive Surgery (MIS) is a procedure that has increased its applications in past few years in different types of surgeries. As number of application fields are increasing day by day, new issues have been arising. In particular, instruments must be inserted through a trocar to access the abdominal cavity without capability of direct manipulation of tissues, so a loss of sensitivity occurs. Generally speaking, the student of medicine or junior surgeons need a lot of practice hours before starting any surgical procedure, since they have to difficulty in acquiring specific skills (hand–eye coordination among others) for this type of surgery. Here is what the surgical simulator present a promising training method using an approach based on Finite Element Method (FEM). The use of continuum mechanics, especially Finite Element Analysis (FEA) has gained an extensive application in medical field in order to simulate soft tissues. In particular, colorectal simulations can be used to understand the interaction between colon and the surrounding tissues and also between colon and instruments. Although several works have been introduced considering small displacements, FEA applied to colorectal surgical procedures with large displacements is a topic that asks for more investigations. This work aims to investigate how FEA can describe non-linear effects induced by

	material properties and different approximating geometries, focusing as test-case application colorectal surgery. More in detail, it shows a comparison between simulations that are performed using both linear and hyperelastic models. These different mechanical behaviours are applied on different geometrical models (planar, cylindrical, 3D-SS and a real model from digital acquisitions 3D-S) with the aim of evaluating the effects of geometric non-linearity. Final aim of the research is to provide a preliminary contribution to the simulation of the interaction between surgical instrument and colon tissues with multi-purpose FEA in order to help the preliminary set-up of different bioengineering tasks like force-contact evaluation or approximated modelling for virtual reality (surgical simulations). In particular, the contribution of this work is focused on the sensitivity analysis of the nonlinearities by FEA in the tissue-tool interaction through an explicit FEA solver. By doing in this way, we aim to demonstrate that the set-up of FEA computational surgical tools may be simplified in order to provide assistance to non-expert FEA engineers or medicians in more precise way of using FEA tools.
Localizzazioni e accesso	http://memoria.depositolegale.it/*/http://hdl.handle.net/11573/1242194