Calculus of Variations

Lecture 1

Prof. Dr. Ayad R. Khudair

We will start our lecture in asking some questions and try to answer them during the next lectures:

- **What is a functional? Give an example for a functional?**
- **Is there a geometric representation? Why?**
- **Is there derivative for a Functional? Why?**
- **What is a neighborhood of a given continuous function? Explain it?**
- **What does a topic study of calculus of variation?**

- **What is the fundamental Lemma of calculus of variation? Can the calculus of variation work without it? Why? Explain in details.**
- **What is the first variation? And what its applications?**
- **Is there a geometric explanation or representation of the first variation?**
- **What is the difference between the properties of the first variation of a functional and the properties of the first derivative of function? Explain in details from applications point of view.**
- **What is the second variation? And what its applications?**
- **Is there a geometric explanation or representation of the second variation?**

- **What is the difference between the properties of the second variation of a functional and the properties of the second derivative of function? Explain in details from applications point of view.**
- **What is the difference between optimization and calculus of variation? Explain in details.**
- **Can you calculate the first variation directly as the first derivative?**
- **What is the Euler differential equation and what its solution represent?**
- **How the order of Euler differential equation in does related with the problems of calculus of variations?**

Thank you for your time