

CHAPTER 1

Introduction to Numerical Methods

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In this lecture, an engineering problem is introduced and its solution using the analytical method and numerical method is discussed. You will observe how the numerical method is capable of solving a complex engineering problem without knowing the analytical solution of the problem. However, numerical methods are always associated with some error due to its behaviour of getting approximate solution instead of an exact solution. Different types of error, while using numerical methods, are also discussed. In this regard, the number representation and arithmetic operation on a computer (32-bit and 64-bit) are covered. At the end of this lecture, types of problem, which can be solved using numerical methods, are briefly introduced which will be covered in more detail in forthcoming lectures.

1.1 A problem and its solution

Let us introduce you an engineering problem of forces acting on a falling object as shown in Fig. 1.1. This problem can be simplified using Newton's law of motion, which states that the time rate of change of momentum of a body is equal to the resultant force acting on it. Therefore, for the given problem of an object falling within the vicinity of the earth, the net force F is composed of two opposing forces: the downward pull of gravity F_D and the upward force of air resistance F_U , i.e.,

$$F = F_D + F_U. \quad (1.1)$$

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