

GRADUALLY VARIED FLOW

23.1 Introduction

The flow in an open-channel is termed as gradually varied flow (GVF) when the depth of flow varies gradually with longitudinal distance. Such flows are encountered both on upstream and downstream sides of control sections. Analysis and computation of gradually varied flow profiles in open-channels are important from the point of view of safe and optimal design and operation of any hydraulic structure.

23.2 Basic Assumptions in GVF Analysis

1. The gradually varied flow to be discussed here considers only steady flows. This implies that (i) flow characteristics do not change with time, and (ii) pressure distribution is hydrostatic over the channel section.
2. The head loss in a reach may be computed using an equation applicable to uniform flow having the same velocity and hydraulic mean radius of the section. This implies that the slope of energy grade line may be evaluated using a uniform flow formula such as Manning equation and Chezy equation, with the corresponding roughness coefficient applicable primarily for uniform flow.
3. Channel bottom slope is small. This implies that the depth of flow measured vertically is same as depth of flow measured perpendicular to channel bottom.
4. There is no air entrainment. Advanced text books may be referred to study the effects of air entrainment.
5. The velocity distribution in the channel section is invariant. This implies that the energy correction factor, α , is a constant and does not vary with distance.
6. The resistance coefficient is not a function of flow characteristics or depth of flow. It does not vary with distance.
7. Channel is [prismatic](#).