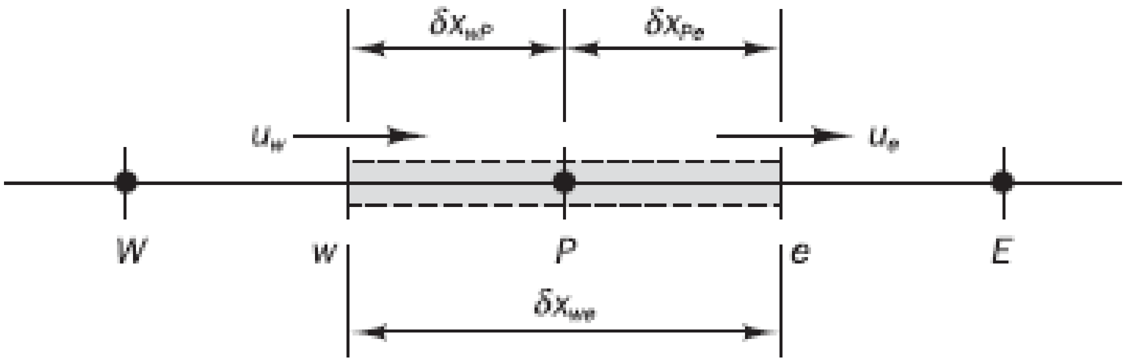
5.1 Introduction

$$\mathrm{div}(\rho\mathbf{u}\phi) = \mathrm{div}(\Gamma\ \mathrm{grad}\ \phi) + S_\phi \tag{5.1}$$

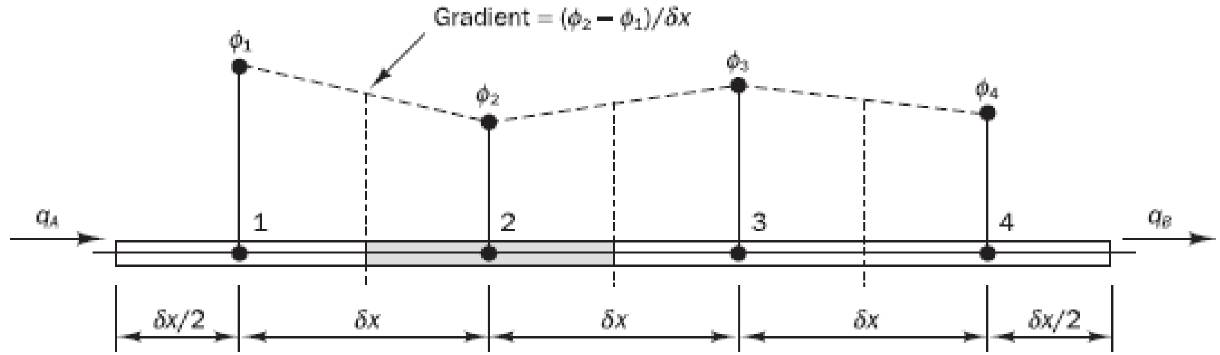
Formal integration over a control volume gives

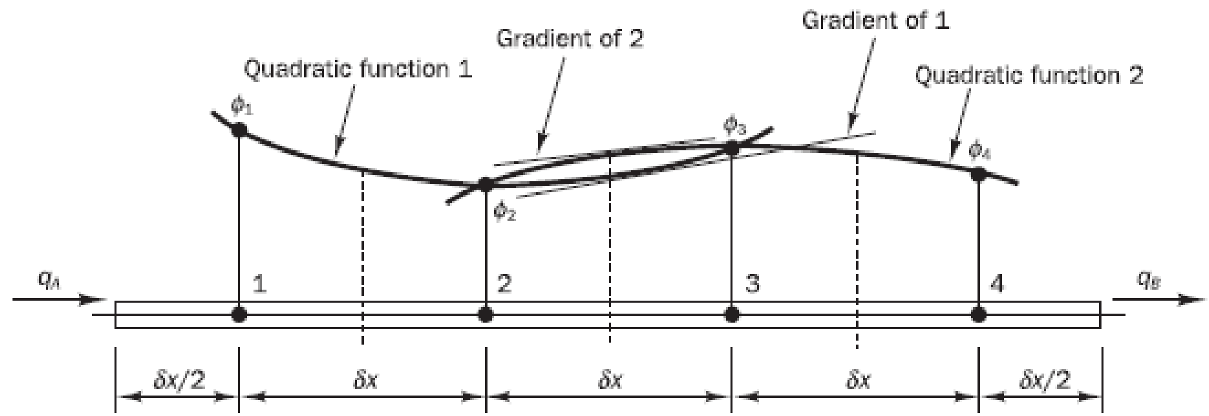
$$\int_A \mathbf{n}\,.\,(\rho\phi\mathbf{u})\mathrm{d}A = \int_A \mathbf{n}\,.\,(\Gamma\ \mathrm{grad}\ \phi)\mathrm{d}A + \int_{CV} S_\phi \mathrm{d}V \tag{5.2}$$

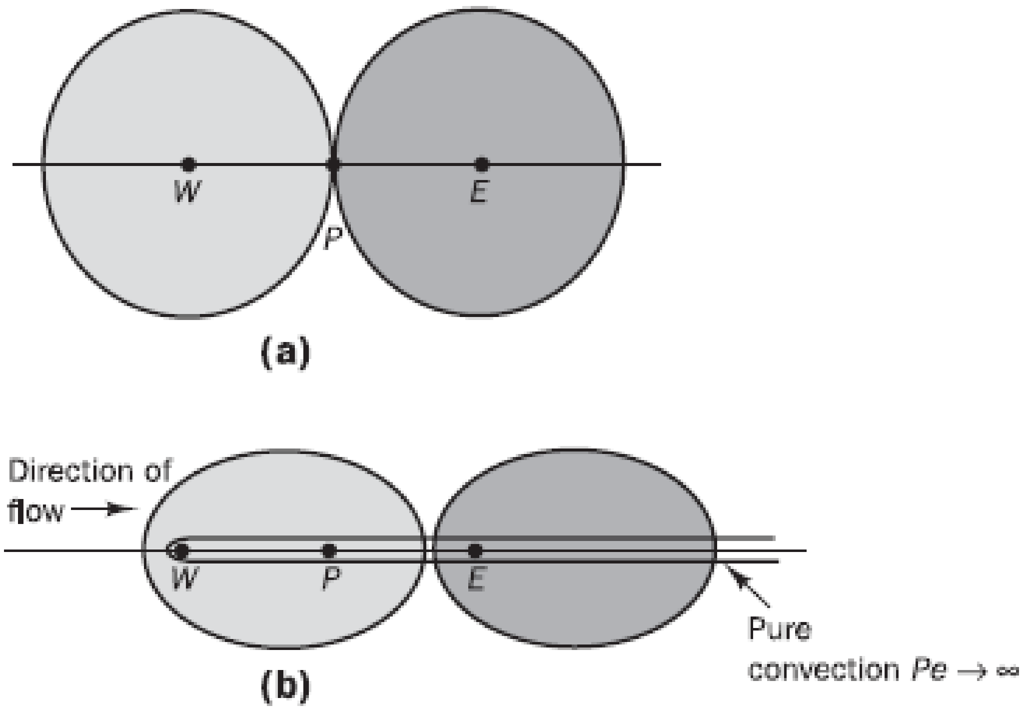
5.2 Steady one-dimensional convection and diffusion



5.4 Properties of discretisation schemes

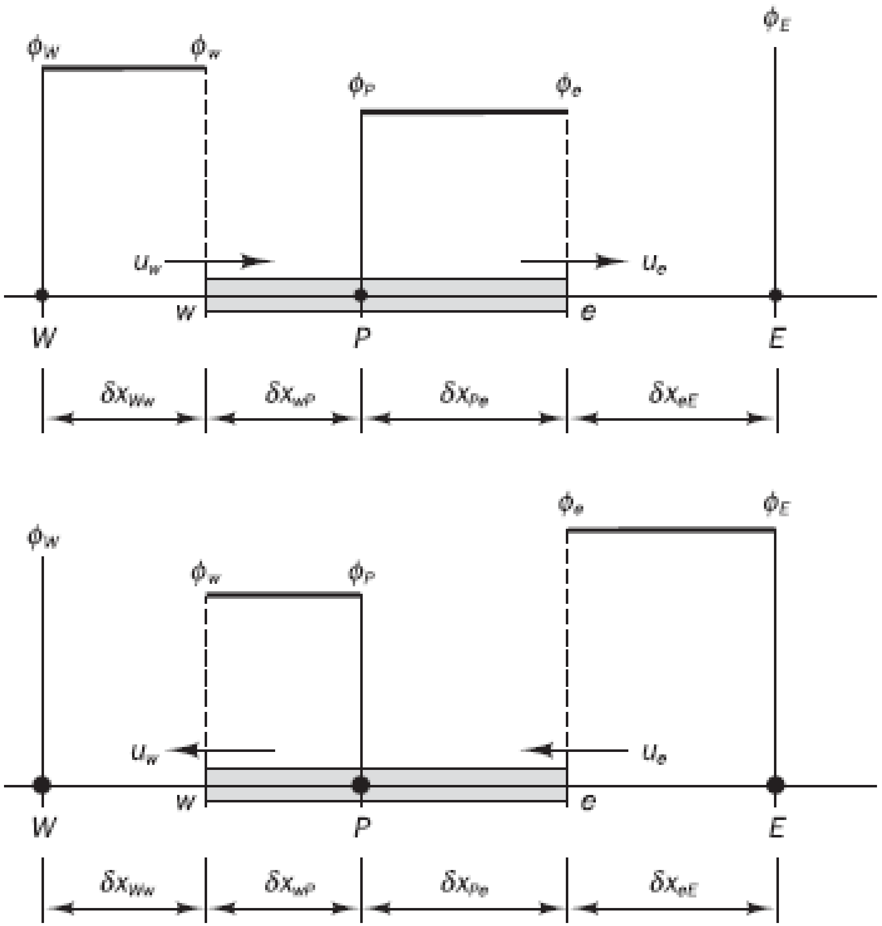




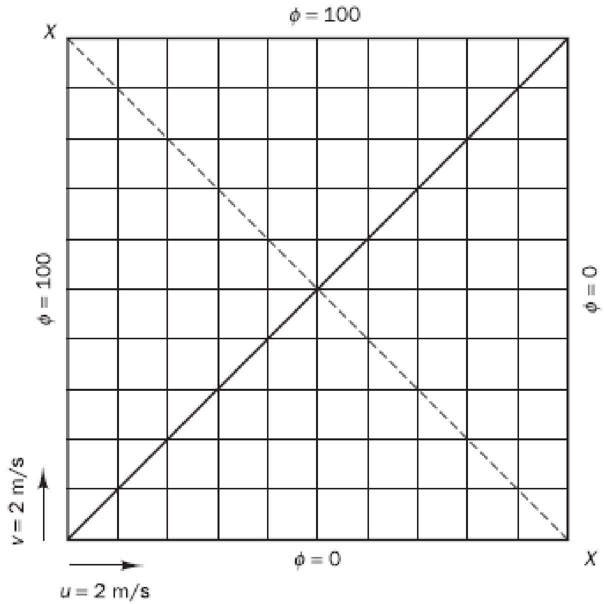


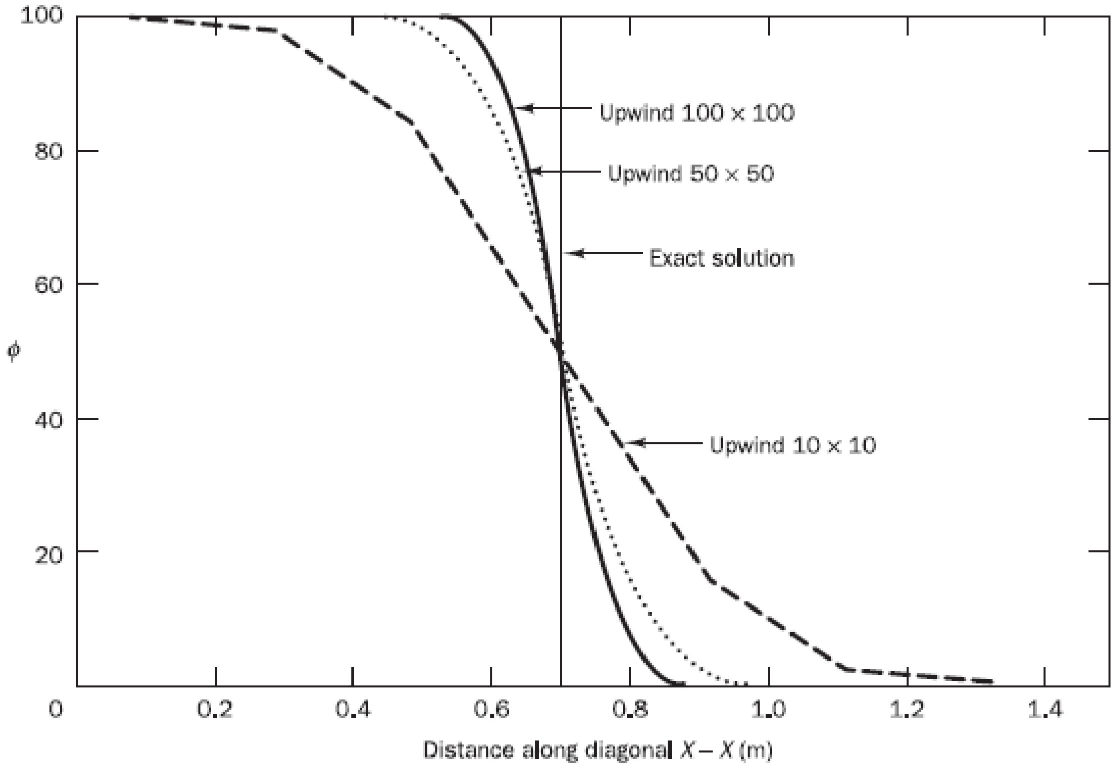
W
E
P
(a)
Direction of flow
W
P
E
Pure convection $Pe \to \infty$
(b)

5.6 The upwind differencing scheme

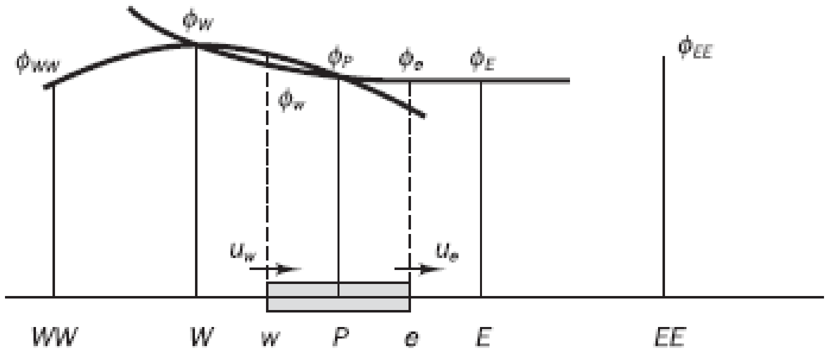


5.6.1 Assessment of the upwind differencing scheme





5.9.1 Quadratic upwind differencing scheme: the QUICK scheme



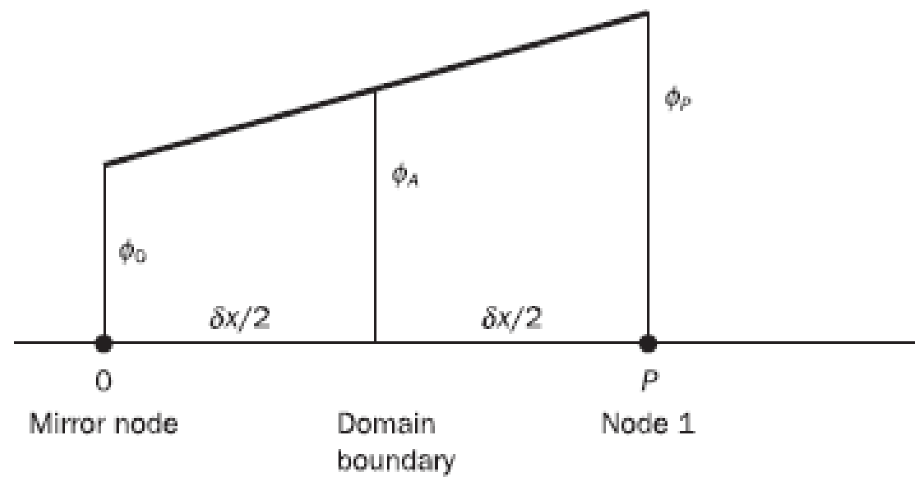
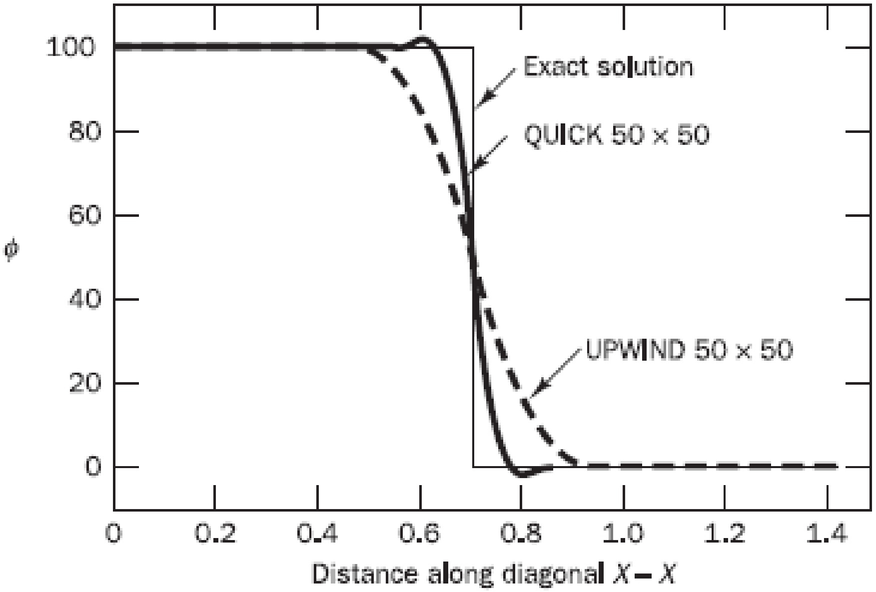
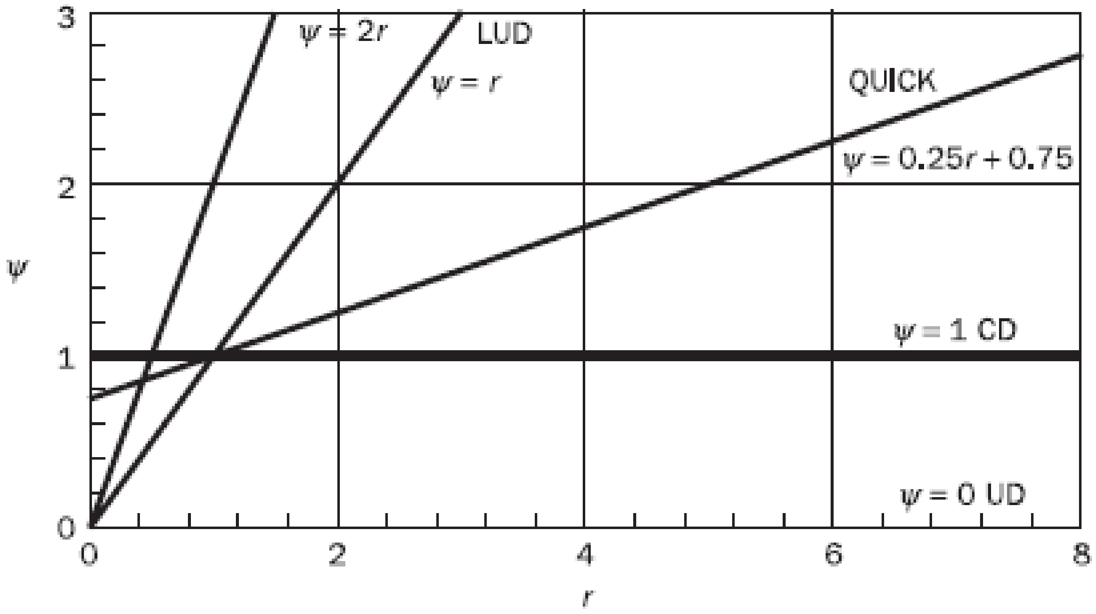


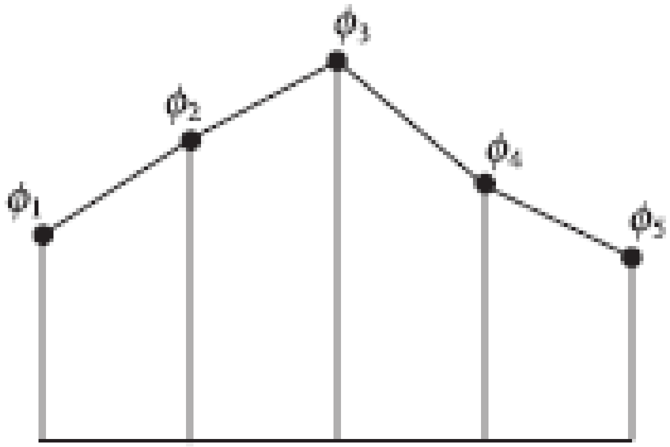
Figure 5.20 Comparison of QUICK and upwind solutions for the 2D test case considered in section 5.6.1



5.10.1 Generalisation of upwind-biased discretisation schemes



5.10.2 Total variation and TVD schemes



5.10.3 Criteria for TVD schemes

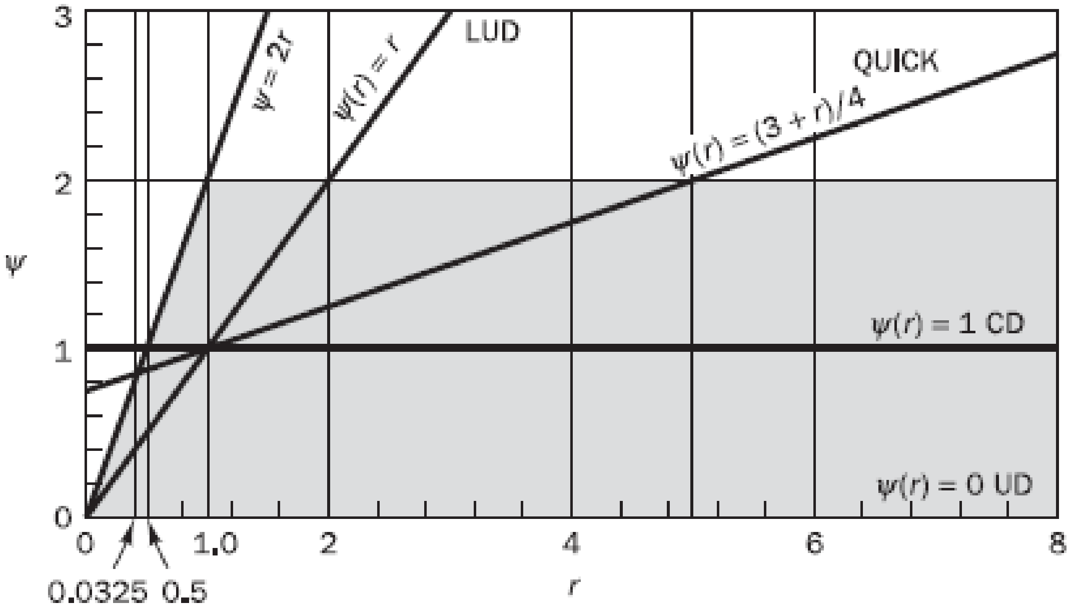
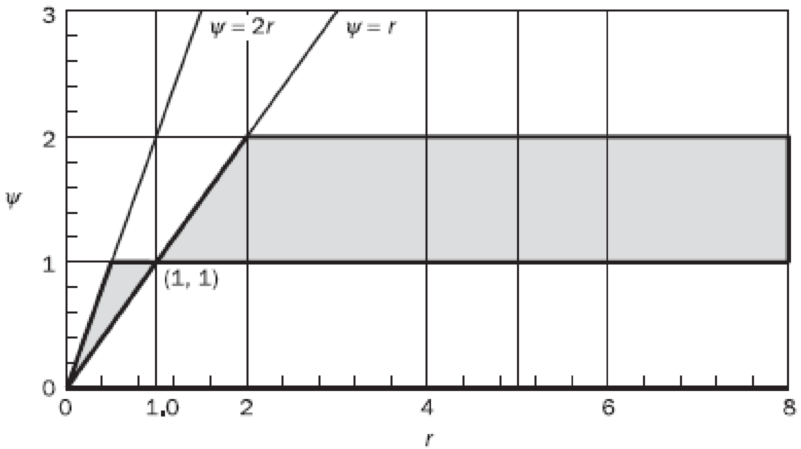


Figure 5.24 Region for a second-order TVD scheme



5.10.4 Flux limiter functions

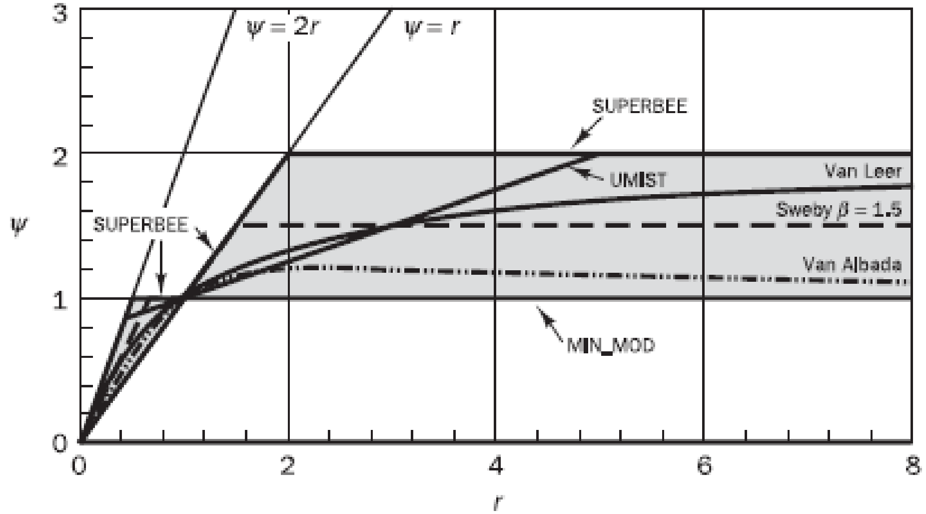


Figure 5.25 All limiter functions in a r–ψ diagram

5.10.6 Evaluation of TVD schemes

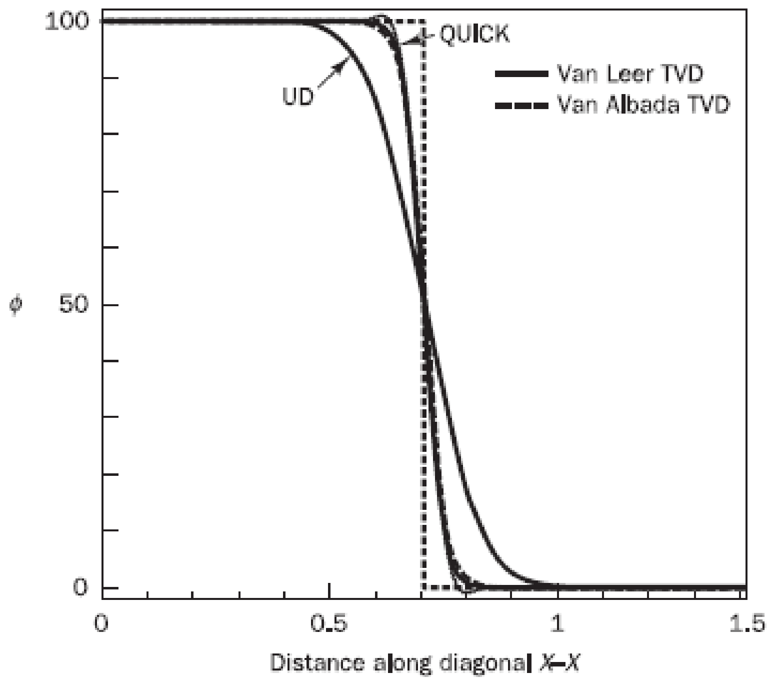


Figure 5.26 Comparison of two TVD schemes: Van Leer and Van Albada with UD and QUICK