

A B S T R A C T

I N T R O D U C T I O N

The theory of the transfer matrix for one-dimensional potential wells is developed, and the conditions under which a coefficient representation and a state-vector representation may be valid, are discussed. A new method, called the 'step' method, is proposed for evaluating the transfer matrices across localized and non-localized "atomic" potentials. The method is applied to some particular potentials, and the numerical results are tabulated. In the case of localized potential wells, a comparison of these results with the transfer matrix of the isolated δ -function potential yields numerical values for the strength of the δ -function. (more detailed statement will be discussed later).

In the case of non-localized potentials this comparison is shown to be impossible. The consequences of this regarding Borland's localization Theorem are then studied. (called, the Borland Transformation Theorem (Theorem 2)). This states that for any localized potential well, there exists a δ -function potential described by the same transfer matrix. Theorem 2 is usually applied to extend any result obtained for the δ -function potential, to more general types of one-dimensional potentials. However, there is no record of any technique for explicitly evaluating the strength of the equivalent δ -function.

The first objective of this study was simply to implement Theorem 2, by evaluating the δ -functions representing some "atomic"-like potential wells. The method of replacing a potential by a histogram, called the 'step' method for brevity, has not been used before in this context. It is of quite general validity, even outside the range of the WKB approximation.

In Chapter 2, we present the theory of the transfer matrix. The principal results were derived previously by Borland, Tong and Hori but they are more precisely stated here than elsewhere.