COMPARATIVE STUDY OF THE SDA BASIS CLOSELY COUPLED MICROSTRIP LINES: A COMPARATIVE STUDY OF THE SDA BASIS FUNCTIONS

**Introduction:**

The spectral domain approach (SDA) has been extensively used to determine the circuit parameters of planar or quasiplanar structures used in the microwave and millimeter wave frequency regimes. The SDA is variational for the modal propagation constant calculation, and the characteristic impedance defined by the power/current density distribution on the infinitely thin and perfectly conducting strips is accurately obtained. Since the SDA for-
(i) the proposed bases have the smoothest current distribution among the obtained bases by the proposed bases get smaller as \( N \) is changed from 6 or 8, to 10 or \( M \) from 10 or 20 to 40, and so on

(iv) each midpoint of the adjacent corners of the zigzag current distributions obtained by the proposed subdomain bases falls on the solutions obtained by the proposed bases.

By deduction, based on the discussions reported in (i) to (iv), we conclude that if \( M \) (in the case of subdomain bases) is further increased to infinity with a sufficient number of spectral terms \( N \), \( J_1 \) and \( J_4 \) obtained by the subdomain bases will have their infinite number of middle points coincide with those obtained by the proposed bases. The same conclusion applies to the field solutions of the C mode. Thus, we conclude that the values for \( Z_0 \) and \( Z_i \) obtained by the proposed bases are accurate and that the proposed set of bases is capable of representing nearly true current distributions on the coupled microstrip lines and becomes a viable set of bases for the SDA analyses of planar or quasilplanar transmission lines.

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LOW THRESHOLD HIGHLY EFFICIENT STRAINED QUANTUM WELL LASERS AT 1.5 MICROMETRE WAVELENGTH

Indexing terms: Lasers and laser applications, Quantum optics

Low threshold and high efficiency operation of strained layer multiple quantum well InGaAs/InGaAsP lasers at 1.5 micrometres wavelength is demonstrated. Current thresholds as low as 2.2 mA with threshold current densities of \( 440 \, \text{A/cm}^2 \) have been obtained. With 7.3 mA threshold current, quantum efficiency was 65% (front facet). At 20 mW CW output power the drive current was as low as 53 mA.

InGaAs/InGaAsP multiple quantum well (MQW) lasers at 1.3 to 1.5 \( \mu \)m wavelength have yielded several advantages over bulk lasers in the same wavelength range, such as low internal loss, high quantum efficiency, low threshold current density, and small linewidth enhancement factors.1-4 There have been several reports predicting that further improvements are possible by employing strained layer quantum wells,5-7 as the effective mass of holes in the heavy hole subband of quantum well layers can be significantly reduced in the plane of the wells by compressive strain. This should result in lower threshold currents and other improvements of the laser