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2.2.2. Homogenization 2.3. CRLH transmission lines; 2.3.1. MetaLine cell; 2.3.2. Case with  $S = p$ ; 2.3.4. Balanced case with  $S = p$ ; 2.4. Some technical approaches to realize MetaLines; 2.4.1. Context; 2.4.2. Discrete component approach; 2.4.3. Distributed or semi-lumped element approach in microstrip technology; 2.4.4. Distributed element approach in coplanar waveguide technology; 2.4.5. The resonant approach; 2.5. Toward tunability; 2.5.1. The dual-band behavior; 2.5.2. Mechanical agility; 2.5.3. CRLH line controlled with active components 2.5.4. Ferroelectric agility 2.5.5. Ferrimagnetic agility; 2.6. Conclusion; 2.7. Bibliography; Chapter 3. Metamaterials for Non-Radiative Microwave Functions and Antennas; 3.1. Introduction; 3.2. Metamaterials for non-radiative applications; 3.2.1. Miniaturization; 3.2.2. Bandwidth improvement; 3.2.3. Dual band; 3.2.4. Zeroth-order resonator (ZOR); 3.3. Metamaterials for antennas at microwave frequencies; 3.3.1. Antenna miniaturization; 3.3.2. Efficient electrically small antennas with metamaterials; 3.3.3. Patch antenna miniaturization considering metamaterial substrate  
3.3.4. Miniature metamaterial antennas: numerical and experimental attempts 3.4. Conclusion; 3.5. Bibliography; Chapter 4. Toward New Prospects for Electromagnetic Compatibility; 4.1. Introduction; 4.2. Electromagnetic compatibility; 4.2.1. Trends in the transport and telecommunication industries; 4.2.2. EMC challenges induced by recent industrial trends - metamaterials for EMC; 4.3. Electromagnetic shielding - potential of metamaterials; 4.3.1. Figures of merit for shielding configurations; 4.3.2. One-dimensional metamaterial shield 4.4. Metamaterials for 3D shielded cavities - application to electromagnetic reverberation chambers

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#### Sommario/riassunto

Since the concept was first proposed at the end of the 20th Century, metamaterials have been the subject of much research and discussion throughout the wave community. More than 10 years later, the number of related published articles is increasing significantly. On the one hand, this success can be attributed to dreams of new physical objects which are the consequences of the singular properties of metamaterials. Among them, we can consider the examples of perfect lensing and invisibility cloaking. On other hand, metamaterials also provide new tools for the design of well-known wave

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