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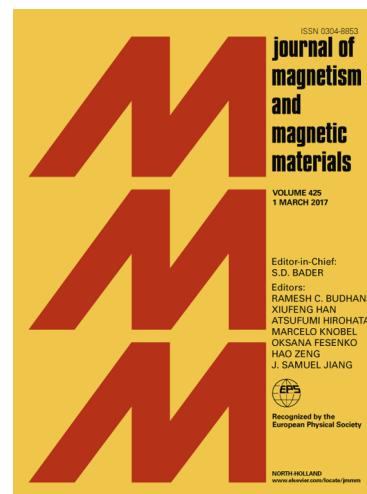
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# Tunable Ferrite-based Metamaterial Structure and Its Application to a Leaky-Wave Antenna

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**Abstract**— In this paper, a new magnetically tunable substrate integrated waveguide (SIW) with composite right/left-handed (CRLH) response is presented. The structure consists of an array of interdigital slots on the upper wall of a SIW line with normally magnetized ferrite substrate. The electromagnetic properties of this structure are studied and the dispersion diagram is considered. The simulated results show that the proposed structure has a separate right- and left-handed leakage frequency region which can be simply controlled by varying the applied ferrite magnetic bias field. As an application, this leakage frequency band is exploited to build a new leaky-wave antenna (LWA) which its radiation pattern can be independently scanned by varying the frequency or the magnetic bias field. As another advantage, there is not any mechanical switch or electrical tuning chip in the proposed leaky-wave antenna.

**Keywords:** fixed frequency beam scanning, leaky wave antenna, magnetized ferrite, metamaterial.

## 1. Introduction

The composite right/left-handed transmission line called metamaterial structure is a guided transmission line with abnormal properties, such as negative phase constant with backward propagation and negative refraction. Due to these special properties, the CRLH transmission

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