1. Introduction

Broadband ferromagnetic resonance microwave spectrometers have become a common experimental tool with which to study dynamic properties of magnetic thin films and nanostructures [1–9]. In this paper we demonstrate a unique ability of this technique for studying exchange effects in magnetic films and at buried interfaces in multilayer geometries. Resonance and standing spin waves are measured for Permalloy films and Permalloy/Cobalt bilayers, and we show how frequencies and amplitudes can be completely understood in terms of conductive layer microwave response.

Standing spin wave modes (SSWMs) are excitations confined by the thickness of the film. The wavelengths of SSWMs are determined by the film thickness and pinning at the surfaces and interfaces. It is well known that the homogeneous microwave magnetic field typically used for ferromagnetic resonance (FMR) cavity experiments does not allow SSWM observation unless pinning [10, 11] or dynamic pinning [12] of magnetization is present at the film surfaces. Driving using a non-homogeneous field, e.g. by placing it on a hole in a wall of a microwave cavity [13], can be used instead to observe the SSWM. Recently it was shown theoretically that a microwave microstrip transducer can be used to couple efficiently to the SSWM[14]. In this scheme, resonant absorption by higher-order SSWM modes of any parity is predicted due to effects of eddy currents excited by the microwave field of stripline transducers. This in fact has allowed us to experimentally study the efficiency of coupling to these modes for an in-plane geometry using a broadband FMR and Network Analyzer technique (NA-FMR).

The plan of the paper is as follows. In the next section we discuss how a hmicrowave stripline transducer can drive standing spinwave modes in conducting multilayers. Results from experiments on single and bilayer structures are presented and discussed in the following two sections. The paper concludes with a discussion of circumstances under which conductivity can be expected to have significant effects in spin wave experiments.

2. Excitation of precession of magnetisation by microwave stripline transducers

Results using two types of microwave transducers, coplanar and microstrip lines, are discussed. The magnetic dynamics of thin magnetic films driven by the microwave field