A Course in Hodge Theory through Periods of Algebraic Cycles

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We will present a quick introduction to the theory of Variations of Hodge Structures, from a more concrete point of view in terms of periods. As an application we will address some cases of the so-called Variational Hodge Conjecture posed by Grothendieck. In Lecture 1 we will recall the basics of sheaf cohomology, hypercohomology and their relation with other classical cohomology theories. In Lecture 2 we will recall the construction of algebraic de Rham cohomology and the classical results of Griffiths about the cohomology of hypersurfaces. Lecture 3 will be devoted to the relation of periods with the notion of Hodge cycles, and to some recent results about the computation of periods of algebraic cycles. In Lecture 4 we will introduce the infinitesimal variations of Hodge structures in terms of the Gauss-Manin connection. And finally in Lecture 5, using the infinitesimal variation of Hodge structures, we will explain the applications to the variational Hodge conjecture in the case of hypersurfaces of the projective space.

Prerequisites: Familiarity with the notions of complex manifold, singular and de Rham cohomology, complex algebraic varieties and coherent sheaves.