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FROBENIUS RECIPROCITY AND LIE GROUP REPRESENTATIONS ON $\bar{\partial}$ COHOMOLOGY SPACES ¹⁾

by Floyd L. WILLIAMS

To the memory of Dr. Walter R. Talbot

1. INTRODUCTION

The general theme of this lecture is Lie group representations on complex $\bar{\partial}$ cohomology spaces and extensions thereby of the classical Frobenius reciprocity theorem. Particular but not exclusive attention will be focused on the representations of semisimple groups. We shall survey some results ranging, historically, from the Borel-Weil-Bott-Kostant theorem to the recent theorem of W. Schmid which confirms the Kostant-Langlands conjecture. We shall also discuss, along these lines, recent results of Moscovici, Verona, Rosenberg and Penney for nilpotent groups. Before developing the particular ideas of the lecture we begin with some broader remarks which may serve as a more general frame of reference.

The finite dimensional representation theory of compact semisimple Lie groups is now a well established chapter in classical mathematics. The theory is due to E. Cartan and H. Weyl [16], [93]. Using non-algebraic methods, Weyl showed the complete reducibility of all (finite dimensional) representations. That is, every representation is the direct sum of irreducible representations. A modern algebraic proof of this fact can be accomplished using Lie algebra cohomology. Cartan classified the irreducible representations by setting up a 1-1 correspondence with the equivalence classes of such representations and the so-called dominant integral linear forms on a Cartan subalgebra of the Lie algebra of the group. This is the celebrated "highest weight" theory. Cartan's case by case approach depended on the classification of the simple Lie algebras. A more

¹⁾ This is an expanded version of an invited address delivered at the 769th meeting of the American Mathematical Society in Washington D.C. on October 20, 1979.