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CLANS DEFINED BY REPRESENTATIONS OF EUCLIDEAN JORDAN ALGEBRAS AND THE ASSOCIATED BASIC RELATIVE INVARIANTS

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Abstract. Starting with a representation ρ of a Euclidean Jordan algebra V by selfadjoint operators on a real Euclidean vector space E , we introduce a clan structure in $V_\rho := E \oplus V$. By the adjunction of a unit element to V_ρ , we obtain a clan V_ρ^* with unit element. By computing the determinant of the right multiplication operators of V_ρ^* , we get an explicit expression of the basic relative invariants of V_ρ^* in terms of the Jordan algebra principal minors of V and the quadratic map associated with ρ . For the dual clan of V_ρ^* , we also obtain an explicit expression of the basic relative invariants in a parallel way.

0. Introduction

Vishberg [15] established a one-to-one correspondence, up to isomorphism, between homogeneous cones domains in Euclidean spaces and certain non-associative algebras called clans. Homogeneous open cones containing an entire line (homogeneous cones for short in what follows) correspond to clans with unit element. Among homogeneous cones, selfdual cones (called symmetric cones) form a nice class, and have been extensively studied from various points of view as presented in the book by Faraut and Korányi [7]. Jordan algebras serve efficiently as an algebraic tool there. In this way the ambient vector space V of a symmetric cone Ω has two algebraic structures, clan and Jordan. At the very beginning of this work, we were interested in the interplay of these two structures. However, with the progress of the work we recognize that this interplay is just a special case (zero representation case) of clans obtained by selfadjoint representations of the Jordan algebra V . The key is that any selfadjoint Jordan algebra representation ρ of V is automatically a representation of the clan V in the sense of [16] (see Proposition 3.3 of this paper). Then ρ is a representation of Ω in the sense of Reibman [14] (see [10]), so that it is a J -morphism of Ω in the sense of Dorfmeister [6]. Thus, our construction of a homogeneous cone from a Jordan algebra representation could be included in a more general scheme developed by Reibman [14] or Dorfmeister [6, 8]. However, we would like to emphasize that since Jordan algebra representations are well-studied, we are able to make everything explicit. In particular, our objective is to obtain an explicit expression of the basic relative invariants in terms of the ingredients of the original Jordan algebra V and its representation ρ .

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