Reductive symmetric spaces are defined as the homogeneous spaces $G/H$ with $G$ a reductive group and $H$ the fixed point group of an involution. To classify these spaces one has to classify the involutions. We show first that there is a natural correspondence between outer involutions and non-degenerate symmetric or skew-symmetric bilinear forms. This enables one to classify isomorphism classes of these involutions using congruence properties of bilinear forms.

We use this to give a detailed characterization for the isomorphism classes of involutions of $SL(n, k)$ and classify them for a number of fields, including algebraically closed fields, real numbers, $p$-adic numbers, and finite fields. Next we give a characterization for the isomorphism classes of involutions of $SO(n, k, \beta)$ where $\beta$ is any non-degenerate symmetric bilinear form. Finally, we classify the involutions of $SO(n, k, \beta)$ in the case of the standard bilinear form for the same fields listed above. (Received September 26, 2005)