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AUTOMORPHISMS OF FIELDS OF FORMAL POWER SERIES

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We propose to discuss in this note on power series fields in one variable the special automorphisms which do not alter the fields of coefficients. It will be proved that the pseudo-ramification groups introduced by MacLane are universal ramification groups, in the sense that a special ramification group must always be a subgroup of a well determined pseudo-ramification group. Finally we interpret the automorphism group of the field as an automorphism group of an infinite Lie ring.

Let Ω be an arbitrary field of characteristic χ. In the sequel we shall consider the field F of all formal power series $a=\sum_{j>-\infty}^{\infty}\omega_j t^j$ where the ω_j are in Ω and t is a transcendental element over Ω.[1] The field F is complete with respect to the rank one valuation V defined by $Va=m$ where m is the smallest subscript j for which $\omega_j\neq 0$. Let $\mathfrak{O}$ be the valuation ring of all holomorphic series and $\mathfrak{P}=(t)$ the principal prime ideal of $\mathfrak{O}$.

Suppose that S is an automorphism of F. We show that $\mathfrak{O}^S$ is also a valuation ring of F. For the proof[2] let a, b be any two nonzero elements of F. We must show that at least one of the quotients a/b, b/a lies in $\mathfrak{O}^S$. By assumption on S there exist unique elements c, d with $c^S=a$, $d^S=b$. Now observe that at least one of the quotients c/d or d/c lies in $\mathfrak{O}$ for $\mathfrak{O}$ is a valuation ring. Therefore at least one of the

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[1] For the basic properties of valuations see [1, 4, 5, 10]. Numbers in brackets refer to the bibliography at the end of the paper.

[2] See [4, p. 165].