

# Abstract

If every finite system of polynomial equations over a ring  $R$  has a solution in the ring  $R$  if and only if it has a solution in  $\hat{R}$  where  $\hat{R}$  represents the completion of  $R$ , then we say that the ring  $R$  has the *Artin approximation property*. M. Artin set in a number of conjectures, the following theorem solved one of them which says, "an excellent Henselian local ring has the property of Artin approximation". General Neron Desingularization is the base of the proof.

Let  $R$  and  $R'$  be Noetherian rings, for a special (that is regular) morphism  $u : R \rightarrow R'$ , any  $R$ -morphism  $\varphi : S \rightarrow R'$  with a finite type  $R$ -algebra  $S$ , factors through an  $R$ -algebra  $T$  which is smooth  $R$ -algebra, that is,  $\varphi$  is a composite  $R$ -morphism of  $S \rightarrow T$  and  $T \rightarrow R'$ . The  $R$ -algebra  $T$  is called a General Néron Desingularization (shortly GND).

In our thesis we give the constructive proof of General Neron Desingularization for the case when  $R$  and  $R'$  are local rings of dimension  $m$  and  $S$  has a big smooth locus, we also give a uniform General Neron Desingularization for local rings of dimension  $m$  along with the algorithms to construct the Néron Desingularization in these cases. Another contribution is that, we give the nested strong Artin approximation.