In this doctoral dissertation, the regularization of the mathematical model was analyzed with the aim of increasing the probability of correct integer estimation in instantaneous carrier phase ambiguity resolution. The analysis was carried out in both the ambiguity and coordinate domains. In the ambiguity domain, an enhancement to the classical regularization method was introduced at the real-valued solution stage. This enhancement involved the use of two distinct regularization parameters, enabling independent regularization of the model parameters of interest. In the coordinate domain, a solution was proposed to the problem of defining the search region in the MAFA-ILS method. This was achieved by introducing conditional regularization at the real-valued solution stage, resulting in an accurately defined, regularized search region. As a consequence of model regularization, an increased probability of correct integer estimation was observed in both domains, along with an optimization of the integer search procedure. However, the introduction of regularization incurred a cost that complicated the model validation procedure. This issue was resolved by replacing the parametric representation of the model with an equivalent implicit form, which - although it omits the parameters of interest - retains full model equivalence. Consequently, the cost associated with regularization was fully eliminated, enabling a rigorous mathematical framework for model validation. The validation of the regularized mathematical model constituted a central problem of this doctoral dissertation.