Integer carrier-phase ambiguity resolution (IAR) is the key to high precision Global Navigation Satellite System (GNSS) applications. IAR improves the precision of the estimated model parameters by at least two orders of magnitude. For positioning, successful IAR effectively transforms the estimated fractional carrier-phases into ultra-precise receiver-satellite ranges, thus making high-precision positioning possible. However, the success of IAR depends on the strength of the underlying GNSS model. The weaker the model, the more data needs to be accumulated before IAR can be successful and the longer it therefore takes before one can profit from the ultra-precise carrier signals. Clearly, the aim is to have short times-to-convergence, preferably zero, thereby enabling truly instantaneous GNSS positioning.

For the purpose of improving IAR performance, this contribution introduces a novel multivariate GNSS model for array-bootstrapped ambiguity resolution. The improved strength of our model will be analysed under various measurement set-ups, like varying number of frequencies (current and future GNSS), varying measurement precision (low-cost and high-grade receivers), varying array-geometry and varying atmospheric decorrelation (medium and long baselines). Various applications will be identified, one being the improvement of ambiguity resolution for continuously operating reference stations (CORS) as used for Network RTK.

The array-bootstrapped ambiguities will be solved using the principle of multivariate mixed integer least-squares estimation. The probability of correct integer estimation (success-rate), the ambiguity dilution of precision (ADOP) and the time-to-successful-fix (TTSF) will be used as performance measures in both our theoretical and empirical analyses. The results show the significant improvements that can be obtained with the multivariate GNSS model.