GNSS CARRIER PHASE PROCESSING USING SOME PROPERTIES OF AMBIGUITY FUNCTION METHOD

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Integer Least Square Adjustment (classic approach)

1) *float solution*

2) *ambiguity resolution*

3) *fixed solution*

Proposal for Integer Least Square Adjustment using Ambiguity Function

General Assumptions:

The adjustment with conditions ensuring 'integerness' of ambiguity

Conditions in the form of linear (or differentiable) function

Mechanism ensuring convergence of the computational process to correct solution

Condition equation of carrier phase observation

$$V = \begin{cases} -\frac{1}{\pi}\arcsin[\sin(\pi s)] \text{ for } s \in \{s : \cos(\pi s) \geq 0\} \\ \frac{1}{\pi}\arcsin[\sin(\pi s)] \text{ for } s \in \{s : \cos(\pi s) < 0\} \end{cases}$$

where :

$$s = \Phi - \frac{1}{\lambda}\rho(X)$$

$$\frac{\partial v}{\partial X} = \frac{1}{\lambda}\frac{\partial \rho}{\partial X}$$

$$V = \frac{1}{\lambda}AX - \Delta$$

Adjustment problem

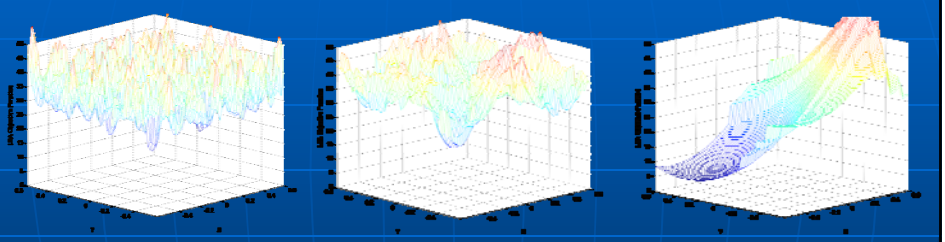
$$V = \frac{1}{\lambda} AX - \Delta$$

$$V^T P V = \min$$

$$\downarrow$$

$$X = \frac{1}{\lambda} \left(A^T P A \right)^{-1} A^T P \Delta$$

The graph of the Objective Function ($\Psi = V^T P V$)
(x,y – variables, z-fixed on correct value)



Carrier phase – signal L_1
wave length – 19 cm

Linear Combination – $L_{(-1,1)}$
wave length – 86 cm

Linear Combination – $L_{(-3,4)}$
wave length – 163 cm

Summary

Proposed method enables precise GPS positioning without the necessity of explicit computation of the carrier phase DD ambiguities, although the condition of their "integerness" is fulfilled

Method is robust to cycle slip effect

The tests show high efficiency when processing short observational sessions up to 25-km baseline using linear combination of L1 and L2 signals

Further research and tests are required in order to fully validate the proposed approach