§3.2.3 Selection of Unknown Parameters and Datum Problem

Generally speaking, the number of unknown parameters (m) should be equal to the number of necessary observations. These m parameters can be m independent direct observations or some other quantities not directly observed. In Example 3.1, we chose two angles which are directly observed as the parameters, while in Example 3.2 (see §3.2), the heights of unknown benchmarks were chosen as unknown parameters. As shown in §3.2.3, it is often convenient to choose the x– and y–coordinates of unknown points as parameters for two dimensional geodetic networks.

The chosen parameters should also be independent, i.e. no parameter can be expressed as a function of other parameters. In a geodetic network with m necessary observations, if we have chosen more than m quantities as unknown parameters, then these m parameters will not be independent and consequently there must exist functional relations among them. If this happens, the general method and basic formulas presented in §3.1 will no longer apply and one should use the method of adjustment by unknowns with constraints to be described in §3.3.

Av+B*delta = f

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For networks with datum defect (i.e. the initial data is not available or insufficient), if we still choose the coordinates of all unknown points as unknown parameters, we will have troubles in the adjustment due to the datum defect problem. Mathematically, the datum defect problem will result in a singular normal equation matrix. The number of rank defect of this matrix is equal to the number of datum defect of the network.

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In this case, least squares adjustment is still possible with the help of generalized matrix inverses (see Chapter §4). However, the unknown parameters (absolute coordinates) cannot be estimated meaningfully, as the coordinate estimates will solely depend on the choice of generalized matrix inverse. From geodetic point of view, each choice of the generalized inverses of the normal equation matrix will *implicitly but unavoidably* assume a specific geodetic datum. More details can be found in §4.1.

It should be reminded that even with datum defect, condition adjustment is always possible, as condition adjustment only adjusts the relationship among the observations (describing the internal geometry of geodetic networks) without involving the datum of the network, neither implicitly nor explicitly.