Difference between Simple Kriging and Ordinary Kriging

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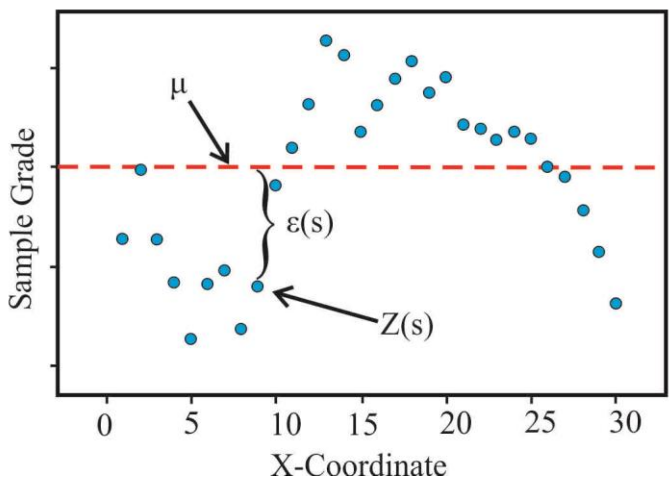
$$[Z^*_{SK}(u_0) - m] = \sum_{i=1}^{n} \lambda_i \, . \, [z(u_i) - m] \qquad (1)$$

$$Y^*_{OK}(u) = \sum_{i=1}^{n} \lambda_i \, . \, Y(u_i) \qquad (2)$$

The equations (1) and (2) represent estimation by Simple and Ordinary Kriging, respectively. The question is why we use the value of mean in the Simple Kriging equation but not in Ordinary Kriging equation and what is the difference between these two Kriging variants? Here I just briefly answer these two questions.

Any random process can be represented as $Z(s) = \mu + \varepsilon(s)$,

where μ is the global mean (dotted red line in figure below) and form the deterministic portion of the data. ε(s) is a random quantity with a mean of 0 (filled blue circle) and form the stochastic portion of the data. We can consider ε(s) as a residual.



In Ordinary Kriging, the global mean in unknown but in Simple Kriging the global mean is known (however, it is unrealistic). Therefore, in Simple Kriging the known mean (m) is subtracted from the data and then added back after residuals have been estimated. Since we know the deterministic portion of a random variable, it is more appropriate to estimate the values as deviation from that global mean.

The assumptions of known and unknown global mean make some other important differences between SK and OK.

Since in OK the global mean is unknown, $\sum_{i=1}^{n} \lambda_i$ is considered to be 1 to satisfy the estimation unbiasedness. In SK we have an assumption about global mean, therefore E(ε)=E[$Y_{SK}^{*}(u) - Y(u)$]=0 will satisfy estimation unbiasedness. Y(u) is true value which unknown.

In OK we can accept a quasi-stationarity condition (varying mean but constant covariance) which means OK estimation is robust even with moderate departures from stationarity condition. Therefore, we can restrict the assumption of stationarity of the mean to the kriging search neighborhood. However, in SK we need stronger assumption of second-order stationarity (constant mean and covariance).

Since satisfying even the second order-stationarity is difficult in a domain of an ore deposit, in association with all reasons mentioned above, OK is the most common linear estimation technique in exploration and mining industries.