Expressions (16.68) and (16.69) give the elements of each row of $\hat{\boldsymbol{G}}$, while expressions (16.70)–(16.72) give the elements of each row of $\hat{\boldsymbol{Z}}$. When the original regression contains a constant term, (16.69) will be perfectly collinear with (16.70) when i and j both index the constant. Therefore, the latter will have to be dropped and the degrees of freedom for the test reduced by one to $\frac{1}{2}(p+2)(p+1)-1$.

Expressions (16.68)–(16.72) show what forms of misspecification the IM test is testing for in the nonlinear regression context. It is evident from (16.71) that the (β_i, σ) regressors are those corresponding to skewness interacting with the $\hat{X}_{ti}$'s. It appears that such skewness, if present, would bias the estimates of the covariances of $\hat{\boldsymbol{\beta}}$ and $\hat{\sigma}$. If we add five times (16.69) to (16.72), the result is $\hat{e}_t^4 - 3$, from which we see that the linearly independent part of the (σ, σ) regressor is testing in the kurtosis direction. Either platykurtosis or leptokurtosis would lead to bias in the estimate of the variance of $\hat{\sigma}$. It is evident from (16.70) that if $x_t(\boldsymbol{\beta})$ were linear, the (β_i, β_j) regressors would be testing for heteroskedasticity of exactly the type that White's (1980) test is designed to detect; see Section 16.5. In the nonlinear regression case considered here, however, these regressors are testing at the same time for misspecification of the regression function. For more details on the special case of linear regression models, see Hall (1987).

The above analysis suggests that, in the case of regression models, it is probably more attractive to test directly for heteroskedasticity, skewness, kurtosis, and misspecification of the regression function than to use an IM test. We have already seen how to test for each of these types of misspecification individually. Individual tests may well be more powerful and more informative than an IM test, especially if only a few things are actually wrong with the model. If one is primarily interested in inferences about $\boldsymbol{\beta}$, then testing for skewness and kurtosis may be optional.

There is one very serious problem with IM tests based on the OPG regression. In finite samples, they tend to reject the null hypothesis much too often when it is true. In this respect, IM tests seem to be even worse than other specification tests based on the OPG regression. Monte Carlo results demonstrating the dreadful finite-sample performance of the OPG version of the IM test may be found in Taylor (1987), Kennan and Neumann (1988), Orme (1990a), Hall (1990), Chesher and Spady (1991), and Davidson and MacKinnon (1992a). In some of these papers, there are cases in which OPG IM tests reject correct null hypotheses virtually all the time. The problem seems to grow worse as the number of degrees of freedom increases, and it does not go away quickly as the sample size increases. One extreme example, given in Davidson and MacKinnon (1992a), is a linear regression model with 10 regressors, and thus 65 degrees of freedom, for which the OPG form of the IM test rejects the true null hypothesis at the nominal 5% level an amazing 99.9% of the time when $n = 200$ and 92.7% of the time even when $n = 1000$.