A new model for parent-of-origin effect analyses applied to Brown Swiss cattle slaughterhouse data

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**Supplementary material**

**Proof of model equivalence**

Model equivalence in Henderson’s sense (1985) requires the expectation  and variance  of the observation vector to be identical under the specifications of both models. Both models do not differ in their fixed effects parts and all random variables have zero expectations. Therefore,  is obviously equal for the *imprinting model* and the *equivalent model* with:

.

The variance of the observations  in the *imprinting model* can be written as:

.

The second part of the latter sum reflects the residual variation and is identical in both models, as already explained. The first part is associated with the numerator relationship matrix  and depicts the covariance of observations due to the resemblance of relatives. After multiplication this covariance becomes:

|  |  |
| --- | --- |
| . | (1) |

The variance of the observations  in the *equivalent model* can be expressed in terms of the incidence matrices and variance components from the *imprinting model*. In particular, the incidence matrix for the TA of sires as sires in the *equivalent model* is the sum of  and  in the *imprinting model*, and the incidence matrix  for imprinting effects in the *equivalent model* equals  from the *imprinting model*, as explained before. Therefore,  in the *equivalent model* becomes:

.

Again we consider only the first part of this sum, which is associated with , in detail. Multiplication gives:



The latter is identical to term 1. In conclusion both conditions from Henderson (1985) are fulfilled and model equivalence has been formally proofed.

**References**

Henderson CR 1985. Equivalent linear models to reduce computations. Journal of Dairy Science 68, 2267–2277.