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Correction to "Frobenius non-classical curves"

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The proof of Proposition 5 of [3] is incomplete. With notation as in the paper, the possibility that the polynomial $X_0^{q/q'} P_0 + X_1^{q/q'} P_1 + X_2^{q/q'} P_2$ in (11) could be identically zero was overlooked. We will sketch here a proof that in this case X does not have controlled singularities so this case can indeed be discarded in the proof of Proposition 5.

Let $F = \sum_{i=0}^{2} X_i P_i^{q'}$ be a generic polynomial of this form with $\deg P_i = \lambda$, (so $d = \deg F = \lambda q' + 1$) with $\sum_{i=0}^{2} X_i^{q/q'} P_i$ identically zero. Thus every common zero of P_0 and P_1 is a zero of $X_2^{q/q'} P_2$ and, since we are in the generic case, is a zero of P_2 and gives a singular point of $F = 0$ with Jacobian ideal of multiplicity at least q' since $\partial F/\partial X_i = P_i^{q'}$. As there are generically λ^2 such points we get $\sum_{P \in X} e_P \geqq \lambda^2 q' > \frac{d}{2}$ and $F = 0$ does not have controlled singularities. As F was generic and controlled singularities is an open condition, the result follows.

Remark. Corollary (5.10) of [2] was improved in [1], Theorem 3, to guarantee, when $p > 2$, that the equation of a non-reflexive curve is of the form $\sum_{i=0}^{2} X_i P_i^{q'}$ if $\sum_{P \in X} e_P < d - 1$ rather than $\sum_{P \in X} e_P < \frac{1}{2} d$.

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References

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