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# On the existence of curves with $A_k$ -singularities on $K3$ -surfaces

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(Submitted on 22 Jul 2011 (v1), last revised 21 Sep 2012 (this version, v4))

Let  $(S, H)$  be a general primitively polarized  $K3$  surface. We prove the existence of curves in  $\mathcal{O}_S(nH)$  with  $A_k$ -singularities and corresponding to regular points of the equisingular deformation locus. Our result is optimal for  $n=1$ . As a corollary, we get the existence of elliptic curves in  $\mathcal{O}_S(nH)$  with a cusp and nodes or a simple tacnode and nodes. We obtain our result by studying the versal deformation family of the  $m$ -tacnode. Finally, we give a regularity condition for families of curves with only  $A_k$ -singularities in  $\mathcal{O}_S(nH)$ .

Comments: 19 pages, misprints corrected, Theorem 1.1 improved and its proof completely changed

Subjects: **Algebraic Geometry (math.AG)**

Cite as: [arXiv:1107.4568](#) [math.AG]

(or [arXiv:1107.4568v4](#) [math.AG] for this version)

## Submission history

From: Concettina Galati [[view email](#)]

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[v2] Sun, 13 Nov 2011 19:00:31 GMT (46kb)

[v3] Fri, 20 Jan 2012 15:52:06 GMT (24kb)

[v4] Fri, 21 Sep 2012 16:38:31 GMT (25kb)

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