

Brieven

| Letters to the editor

The Atiyah-Singer index formula

I read 'De indexstelling van Atiyah en Singer' by N.P. Landsman (NAW 5/5 no. 3, 207–211 (2004)). I liked it and enjoyed reading it. I was very happy to see there the photo of my teacher, myself, and the son of my teacher's teacher. Thank you for mentioning us. Unfortunately, there are some small omissions in the paper.

1. The 'indexstelling van Gohberg en Krein' on page 208 is in fact due to Fritz Noether ('Ueber eine Klasse Singulaerer . . .', *Math. Ann.* 82 (1921), 42–63). In Noether's paper the formulation is different, and the index is not defined, but the formula is there, and the proof is correct for analytic functions. We (M.G. Krein and myself) gave the formula for the matrix case. N.I. Mushelishvili and N.P. Vekua have to be mentioned as well. An early version of the index formula for elliptic systems was obtained by A. Vol'pert. The latter was a preliminary version of Atiyah-Singer index formula.

2. Fritz Noether was the son of Max Noether and the brother of the famous Emmy Noether. Note that it was the time that such great mathematicians as D. Hilbert, H. Poincaré, B. Riemann, J. Plemelj and others were involved in this area, but only F. Noether understood the importance of the index, gave the first explicit formula, and emphasized the difference with the work of Fredholm (whose work, considered operators, which have zero index).

3. I consider it very unfortunate that in the very interesting interview of Atiyah and Singer in the *European Math. Soc. Newsletter* (53, 2004) the names of the pioneers F. Noether and I. Fredholm are not mentioned.

4. More details about Fritz Noether and his work can be found in the journal *Integral Equations and Operator Theory* v.8 (1985) Birkhäuser, pp. 573–579. From the introduction of the editor to this Journal for this issue I quote: "This issue of Integral Equation and Operator Theory is dedicated to the memory of Fritz Noether. It contains a selection of update papers on the index theory. Included is a biography of Fritz Noether with its very tragic end. This biography has been written by his son for this issue. There is also a list of publications by F. Noether, compiled by A. Dick. J.A. Dieudonné has written for this issue a paper about the early history of the index theory."

5. See also *Integral Equations and Operator Theory* v.13 (1990) pp. 303–305, where the official document about the arrest and execution of Fritz Noether in the former USSR is presented.

6. For the abstract index theory also the names of F. Riesz, J. Dieudonné, F.V. Atkinson and B. Yood have to be mentioned.

Israel Gohberg, 16 October 2004, Tel Aviv