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JOOST J. KALKER (1933–2006): A LIFE IN ROLLING CONTACT

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Joost Kalker, famous for his mathematical description of the wheel–rail contact, died on April 24, 2006 of heart failure, at the age of 72. Apart from a heart condition, which he developed earlier in life, he suffered the last ten years from Parkinson's disease.

Joost Kalker was born in The Hague on July 25, 1933 to a Jewish family. His father was a general practitioner and his mother a dentist. As a Jew, Kalker was persecuted during World War II. He survived the Holocaust by hiding with different families, separated from his parents and sister, during several years. His father was betrayed and died in Auschwitz. After the war, his mother took up her occupation again as a dentist to support her children.

Joost attended the gymnasium (secondary school) in the Hague from 1945–51 and entered TUDelft as a student of applied physics. After some time he got himself transferred to applied mathematics. This department was new and founded by Prof Rein Timman, an applied mathematician with many contacts in industry. The new curriculum was focused on applied opposed to pure mathematics with courses in numerical analysis, algorithms, and computer programming. The latter was taught by Prof van der Poel who gave Joost a never-ending love for computers and programming. Timman would play an important role in Joost's life. It was also here that he met his wife Cornelia Kalkman (Cokkie). Advised by Timman, Joost did his graduate work at Dutch Rail under the supervision of Ton de Pater who was then head of the research department. The topic of Joost's MSc thesis was 'The forces transmitted by two elastic bodies' [1] and it

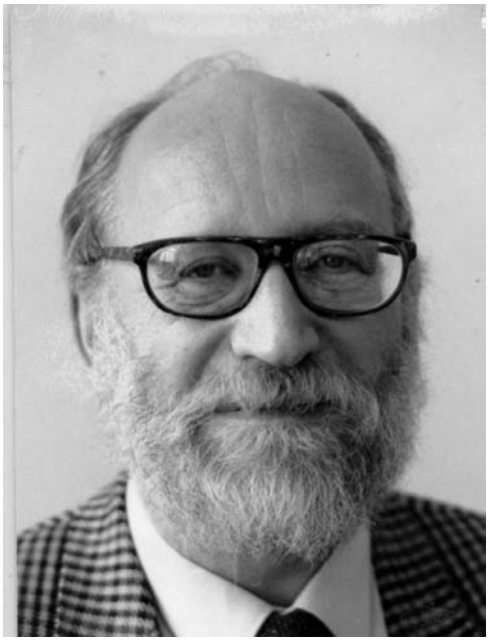

Figure 1. Joost J. Kalker 1933–2006.

was during this period that Joost met Ken J. Johnson [2] from Cambridge, UK, who was then working for British Rail. They would become life-long colleagues and friends. Joost graduated cum laude in 1958 as the first Mathematical Engineer. Two years later his wife would graduate on the topic of special functions of

a complex variable as the first female Mathematical Engineer.

During his graduate studies 1956–57, he got a Fulbright grant and worked as a Research Associate at Brown University, USA, in the Applied Mathematics group of Prager and Sternberg. Joost worked on a programming scheme for the automatic minimum weight design of steel frames implemented on an IBM 704 computer [3]. Back in the Netherlands he finished his studies and then went into military service. In those days the Netherlands was still at war in the East Indies and Joost got drafted for the Marine Intelligence where he worked on highly classified material such as coding and decoding of messages. After his military service 1960 he was appointed Assistant Professor at TUDelft where he first worked with Timman en later with Ton de Pater who, in the mean time, had been appointed full Professor at Mechanical Engineering in the group of Prof. W. T. Koiter.

His PhD dissertation 1967, advised by de Pater and Timman, entitled 'On the rolling contact of two elastic bodies in the presence of dry friction' [5] was a real magnum opus, now sadly out of print. After the initial work by Carter and Fromm 1926 it established for all time the mechanics of frictional rolling contact under arbitrary combinations of tangential force and spin, which govern the curving and dynamical stability of railway vehicles. His results are used by the railway dynamicists world wide. In deriving these results, he acknowledges Timman in the Maths Department as his effective supervisor. Perhaps he was responsible for the rather formal mathematical way in which Joosts papers were written, which caused so much angst in his engineering readers. Joost's career continues and in 1979 he is appointed full Professor at TUDelft on a personal chair in applied mathematics.

Meanwhile, De Pater initiated more rolling contact research. Not only did he point out Joost into the direction of wheel–rail contact, he was also the advisor of Hans Pacejka in his 1966 PhD work on the theoretical and experimental investigation of the wheel shimmy phenomena in pneumatic tires [4]. Pacejka too became a Professor at Delft and was highly successful in the phenomenological and experimentally based modelling of tires, the so-called 'Magic Formula' tire models [18].

Joost became a living legend. The linear elastic coefficients in his theory became known as the 'Kalker Coefficients'. Given his educational background, Joost programmed the theory himself into a number of computer codes of which the code CONTACT [8] is probably the most famous. After some time Joost understood the drawbacks of this code. It was too slow to fit into a larger system for dynamic simulation of the motion of railway vehicle systems. He showed that he was not slavishly tied to mathematical exactitude and developed a simplified theory, in which the elastic continua were replaced by Winkler foundation type models. This gave rise to readily calculated values of contact forces in conditions of arbitrary creep. Next, he programmed the model into a code called FASTSIM [7], his second best cited work. It is not surprising to see a close resemblance of such a model with a model for tire–road interaction. Over the years the wheel–rail contact software turned out to be very successful and is still supported and distributed [20].

In the years that followed, further significant advances were achieved. In 1979, Kalker presented a state of the art 'Survey of wheelrail rolling contact theory' [6] at the IAVSD Conference, followed by several papers on wheelrail contact mechanics published in the journal of Vehicle System Dynamics. For a number of years, he was a member of the Editorial Board. Kalker was the first to tackle the transient rolling contact problem that follows a sudden change of imposed force, or under the action of an oscillating force. He also developed a variational method for finding the contact area and pressure with arbitrary profiled bodies [9]. All these works were brought together in a scholarly, but eminently useful book: Three dimensional elastic bodies in rolling contact [10], his best cited work.

By combining Archards wear law [16] (wear rate is proportional to the product of contact pressure and sliding speed) with rolling contact mechanics, Kalker and his PhD student Fréderic Périard predicted the wear of wheels and rails during curving and dynamic motion of the vehicle [17]. Joost was advisor to six PhD students in total. The first was Max Viergever 1980 who worked together with Prof E. de Boer on a mathematical approach to the mechanics of the inner ear [12]. Then followed François van Geer 1987 on groundwater monitoring networks [13], Juergen Jaeger 1992 on elastic impact with friction [14], Gerard Braat 1993 on layered visco-elastic cylinders in rolling contact [15] with applications to paper copying machines, Périard 1998, and lastly Zili Li 2002 on wear simulation in wheel–rail contact [19].

In 1999, Kalker organised a course on 'Rolling Contact Phenomena' at the International Centre for Mechanical Sciences at Udine in Italy, with seven leading experts as lecturers and 60 students. The proceedings [11] provide the best possible introduction to the subject for the student of vehicle system dynamics. It was a very fitting climax to a most successful career.

During his last years, Joost had plenty of time to look back and reflect upon his life . He concluded that after a difficult start he has had a very rewarding and happy life. He was able to do the things he liked. He immensely enjoyed his international contacts and their appreciation for his work and he considered his colleagues and students as his friends. Like in his work, quality was very important to him in all aspects of his life. One of his hobbies was cooking, many of his friends will remember the many parties he gave in his home and garden, with home-made food. He also loved the traveling his work implied and was very grateful for the way he was received and was shown to other cultures. He certainly had a very happy family life and combined that very easily and naturally with his working activities. He has led a very productive life and gave us a lot of good things to remember and be grateful for.

He is survived by his devoted wife, Cokkie; two daughters, Titia and Pauline; and three grandchildren, Floor, Simon and Felix.

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