The Mooney–Rivlin equation was used to determine the degree of crosslinking of rubbers based on their stress–strain behaviour. Non-linear behaviour of the Mooney–Rivlin curve under valid elongation and changes in the crosslink density for swollen NR vulcanisates were observed, in contrast to unswollen vulcanisates. The non-linear behaviour was caused by prior–extensibility of the rubbers whereas the change in the degree of crosslinking resulted from differences in the directional stresses in the NR compounds during swelling. The crosslink densities from the use of the Mooney–Rivlin equation were then compared to those obtained from a swelling method based on the Flory–Rehner equation.