* Shocks described as homogeneous Poisson process with (constant) parameter -> time to next occurrence described with an exponential distribution
* Single shock event (no aftershocks)
* Shock magnitude described with the modern equivalent of the Gutenberg-Richter distribution, namely the doubly bounded exponential distribution characterized with the parameters with PDF:
* Single-point source of earthquake
* Asssume homogeneous material over the entire area of the graph -> homogeneous intensity of the earthquake in all directions
* Location of earthquake described as 2D, no depth component
* For simplicity, peak-ground-acceleration (PGA) as only intensity measure (IM) of the earthquake at each segment -> can be computed at all nodes given the earthquake magnitude and the segment distances to the hotspot
* IM decreases with increasing distance as a result of both geometric spreading and anelastic attenuation
* Peak-ground acceleration (PGA) chosen as intensity measure.
* BFJ97 [2] model chosen to describe the relationship between the local PGA the earthquake magnitude m and distance to the earthquake:

Where the List of parameters is given:

|  |  |
| --- | --- |
|  | 0.441 |
|  | 0.527 |
|  | -0.778 |
|  | 5.57 |

Which leads to the PGA curves

Ein Bild, das Text, Screenshot, Reihe, Diagramm enthält.

Automatisch generierte Beschreibung

* Failure is usually lognormally distributed (capacity is log-normally distributed):

-> capacity to resist failure is a random variable, where is the median capacity and is the standard deviation of causing failure. In our case, we have not two, but 4 discrete deterioration states -> , where is the -th damage state, increasing values of indicate more severe damage, and the fragility parameters and are specified for each damage state. The multiple damage states are in our case mutually exclusive and collectively exhaustive.

Ein Bild, das Text, Diagramm, Reihe, parallel enthält.

Automatisch generierte Beschreibung

* Given the fragility curves, the probabilities of transitioning into another state are:
* In our case, we already have a deterioration scheme, which leads to shifts in the curves in order to satisfy minimum transition probabilities.

**Computed at runtime**

**Segment deterioration:**

From PGAs & fragility curves and current deterioration tables (including correlation), shock effect can be added

**Can be precomputed**

**Effect at segments:**

Peak-ground-acceleration (PGA) given magnitude distance

**Earthquake & env characteristics:**

1. Occurrence times
2. Locations
3. Magnitudes
4. Fragility curves

Source:

Baker, J., Bradley, B., & Stafford, P. (2021). *Seismic hazard and risk analysis*. Cambridge University Press.

Boore, D. M., Joyner, W. B., & Fumal, T. E. (1997). Equations for estimating horizontal response spectra and peak acceleration from western North American earthquakes: A summary of recent work. *Seismological research letters*, *68*(1), 128-153.