The principle of operation of the multilayer shim of FIG. 5 differs from that of the shim of FIG. 4. The shim of FIG. 5 accommodates the relative movement between the dovetail side 28 and the slot side wall 22, in the contacting region 32, by sliding movement within the shim itself. There is little sliding movement between the shim and the titanium pieces. By contrast, the shim of FIG. 4 accommodates relative movement by sliding of the anti-fretting layer of the shim against the bearing surface of each titanium part, which does not damage the titanium because of the choice of the material used in the anti-fretting layer.

The use of the shim of the present invention in engine applications has delayed the onset of fretting. Use of a reinforced shim of this invention made from IN-718 and bronze has delayed the onset of fretting for greater than 2000 cycles of operation. The use of a bronze shim has delayed the onset of fretting for more than 1500 cycles. In contrast, fretting has been observed in a system having no shim, but with titanium blades inserted in titanium rotors, but coated with a molybdenum disulfide lubricant, in less than about 200 cycles. Thus, the advantage of the shim of the present invention in reducing the onset of fretting and the consequent reduction or elimination in fatigue damage in blade/disk systems can be readily seen, since the number of engine cycles before the onset of fretting is increased by a factor of seven to greater than 10, depending on the shim selected.

Although the present invention has been described in connection with specific examples and embodiments, it will be understood by those skilled in the arts involved that the present invention is capable of modification without departing from its spirit and scope as represented by the appended claims.

What is claimed is:

1. An assembly for a turbine engine, comprising:
- a titanium rotor having a dovetail slot in a rotor circumference thereof, the dovetail slot including at least a pair of sidewalls diverging in a direction from the circumference toward an inward portion of the rotor, and terminating at a bottom;
- a titanium blade having a dovetail sized to fit into the dovetail slot and contact the rotor along a pair of contacting regions on the inwardly diverging sidewalls of the dovetail slot, one contacting region being located on each side of the dovetail slot, there remaining a non-contacting region between the blade dovetail and the dovetail slot; and
- a shim disposed between the blade dovetail and the dovetail slot, the shim including
  - (a) an anti-fretting layer interposed between the dovetail and the dovetail slot over both the contacting regions and the non-contacting region, the anti-fretting layer being formed of a material that does not exhibit fretting when rubbed against titanium,
  - (b) a doubler overlying only that portion of the anti-fretting layer that is disposed over the non-contacting region, and
  - (c) a joint joining together the anti-fretting layer and the doubler in the non-contacting region.

2. The assembly of claim 1, wherein the anti-fretting material is phosphor bronze.

3. The assembly of claim 1, wherein the doubler is formed of a material selected from the group consisting of a copper-base alloy, a nickel-base alloy, a cobalt-base alloy, and a steel.

4. The assembly of claim 1, wherein the joint is a weld joint.

5. The assembly of claim 1, wherein the joint is a braze joint.

6. An assembly for a turbine engine, comprising:
- a titanium rotor having a dovetail slot in the circumference thereof, the dovetail slot including at least a pair of sidewalls diverging in a direction from the circumference toward an inward portion of the rotor, and terminating at a bottom;
- a titanium blade having a dovetail sized to fit into the dovetail slot and contact the rotor along a pair of contacting regions on the inwardly diverging sidewalls of the dovetail slot, one contacting region being located on each side of the dovetail slot, there remaining a non-contacting region between the blade dovetail and the dovetail slot; and
- a multilayer shim disposed between the dovetail and the dovetail slot, the shim including:
  - (a) a first layer adjacent the dovetail slot and having an inner and an outer surface, the first layer having a slip-inhibiting material on the outer surface lying adjacent the contacting regions of the rotor dovetail slot, and a slip-promoting material on the inner surface oppositely disposed from the outer surface;
  - (b) a second layer adjacent the blade dovetail and having an inner and an outer surface, the second layer having a slip-inhibiting material on the inner surface lying adjacent the contacting regions of the blade dovetail, and a slip-promoting material on the outer surface oppositely disposed from the inner surface, the slip-inhibiting material of each layer being in contact with the adjacent titanium piece and acting to inhibit sliding movement between the shim and the titanium piece, and the slip-promoting material of the first layer being in contact with the slip-promoting material of the second layer such that relative movement between the blade dovetail and the dovetail slot is accommodated by sliding of the slip-promoting materials over each other;
  - (c) a high strength doubler overlying only that portion of the first layer that is disposed over the non-contacting region; and
  - (d) a joint joining together the first layer and the doubler in the non-contacting region.

7. The assembly of claim 6, wherein the first layer and the second layer are formed of a nickel-base superalloy.

8. The assembly of claim 6, wherein the slip-inhibiting material is selected from the group consisting of copper and aluminum bronze.

9. The assembly of claim 6, wherein the slip-promoting material is selected from the group consisting of molybdenum disulfide, titanium nitride, poly(tetrafluoroethylene) and a lubricant comprising poly(tetrafluoroethylene), bentonite, inorganic oxide particles and an epoxy.

10. An assembly for a turbine engine, comprising:
- a titanium rotor having a dovetail slot in a circumference thereof, the dovetail slot including at least a pair of sidewalls diverging in a direction from the circumference toward an inward portion of the rotor, and terminating at a bottom;
- a titanium blade having a dovetail sized to fit into the dovetail slot and contact the rotor along a pair of contacting regions on the inwardly diverging sidewalls of the dovetail slot, one contacting region