CLAIMS

What is claimed is:

1. A method for reducing fluid drag, or generating improved stall characteristics and agility, or improved heat exchange, the method comprising:

providing a body surface or control surface;

applying at least one device to the body surface;

wherein the device is configured to produce turbulence with minimal fluid separation;

wherein the close to the surface turbulence assists the heat exchange in a convectional manner;

wherein the turbulence extends directly behind the device and with its low dynamic pressure promoting downward, toward the surface fluid motion stabilizing the flow;

wherein the turbulence produced is in the form of a plurality of counter rotating, just touching vortices appearing as tubes down the fluid flow; and

wherein the turbulence produced is in the form of two counter rotating, just touching vortices appearing as tubes down the fluid flow, in the form of quadruple, two by two counter rotating vortices appearing as tubes down the fluid flow or plurality of counter rotating vortice pairs; and

wherein a size of the at least one device relative to a characteristic dimension of the body surface or control surface is between 0.3% and 3% of the corresponding dimension in that direction of the body or control surface the device is attached to.

2. The method of claim 1, wherein the device comprises barchan dune like structure, hill like or bump like structure, with additional size reduction up to a factor of ten, accounting for the shape effectiveness in the particular fluid flow regime.

3. The method of claim 1 wherein the device comprises various wedge forms, semi-cylinder, semi-sphere, pyramids, cubes, semi-cone, with additional size reduction up to a factor of seven, accounting for the shape effectiveness in the particular fluid flow regime.

4. The method of claim 1, 2 or 3, wherein the device comprises a plurality of devices arranged one behind another on the fluid flow lines, wherein the applying of the at least one device comprises the applying of a first of the plurality of devices at a first location on the body

surface and applying a second of the plurality of devices at a second location spaced apart from the first location by a length greater than five times a height of the first device relative to the body surface.

5. The method of claim 1, 2, or 3, wherein the device comprises a plurality of devices, and wherein the application of the devices further comprises arranging the devices perpendicularly to the flow lines.

6. The method of claim 1, 2, or 3, wherein device comprises a plurality of devices, and wherein the application of the devices further comprises arranging the devices randomly normally and tangentially to the flow offsets and to one another.

7. An apparatus for reducing drag, or improved stall characteristics, or improved heat exchange comprising:

a) a body having at least one body surface; and

b) at least one device on the body surface;

c) wherein the device is configured to produce turbulence with minimal fluid separation;

d) wherein the turbulence produced extends with the flow directly behind the device and stays close to the surface;

e) wherein the close to the surface turbulence assists the heat exchange in a convectional manner;

f) wherein the turbulence extends directly behind the device and with its low dynamic pressure promoting downward, toward the surface fluid motion stabilizing the flow;

g) wherein the turbulence produced is in the form of a plurality of counter rotating, just touching vortices appearing as tubes down the fluid flow; and

h) wherein the turbulence produced is in the form of two counter rotating, just touching vortices appearing as tubes down the fluid flow, or in the form of quadruple, two by two counter rotating vortices appearing as tubes down the fluid flow, or in the form of plurality of counter rotaiting vortice pairs; and

i) wherein a size of the at least one device relative to a characteristic dimension of the body surface or control surface is between 0.3% and 3% of the corresponding dimension in that direction of the body or control surface the device is attached to.

8. The apparatus of claim 7, wherein the device comprises barchan dune like, a hill like or bump like structure, with additional size reduction up to a factor of ten, accounting for the shape effectiveness in the particular fluid flow regime, or wherein the device comprises various wedge forms, semi-cylinder, semi-sphere, pyramids, cubes, semi-cone, with additional size reduction up to a factor of seven, accounting for the shape effectiveness in the particular fluid flow regime.

9. The apparatus of claim 7 or 8, wherein the device comprises a plurality of devices arranged one behind another on the fluid flow lines, wherein the plurality of devices are spaced apart by a length greater than five times a height of the device relative to the body surface.

10. The apparatus of claim 7 or 8, wherein the device comprises a plurality of devices, and wherein the devices are on the body surface perpendicularly to the flow lines.

11. The apparatus of claim 7 or 8, wherein device comprises a plurality of devices, and wherein the devices are located randomly on the body surface normally and tangentially to the flow offsets and to one another.

12. An apparatus for improved stall characteristics comprising:

a) a body having at least one body surface; and

b) at least one device on the body surface;

c) wherein the device is configured to produce turbulence with minimal fluid separation;

d) wherein the turbulence extends directly behind the device and with its low dynamic pressure promoting downward, toward the surface fluid motion stabilizing the flow; and

e) wherein a size of the at least one device relative to a characteristic dimension of the at least one body surface is between 0.3% and 3% of the corresponding dimension in that direction of the at least one body surface the device is attached to.

13. The apparatus of claim 12, wherein the device comprises barchan dune like structure, with additional size reduction up to a factor of ten, accounting for the shape effectiveness in the particular fluid flow regime.

14. The apparatus of claim 12, wherein the device comprises a hill like or bump like structure, with additional size reduction up to a factor of ten, accounting for the shape effectiveness in the particular fluid flow regime.

15. The apparatus of claim 12, 13 or 14, wherein the device comprises a plurality of devices arranged one behind another on the fluid flow lines, and wherein the plurality of devices are spaced apart by a length greater than five times a height of the device relative to the body surface.